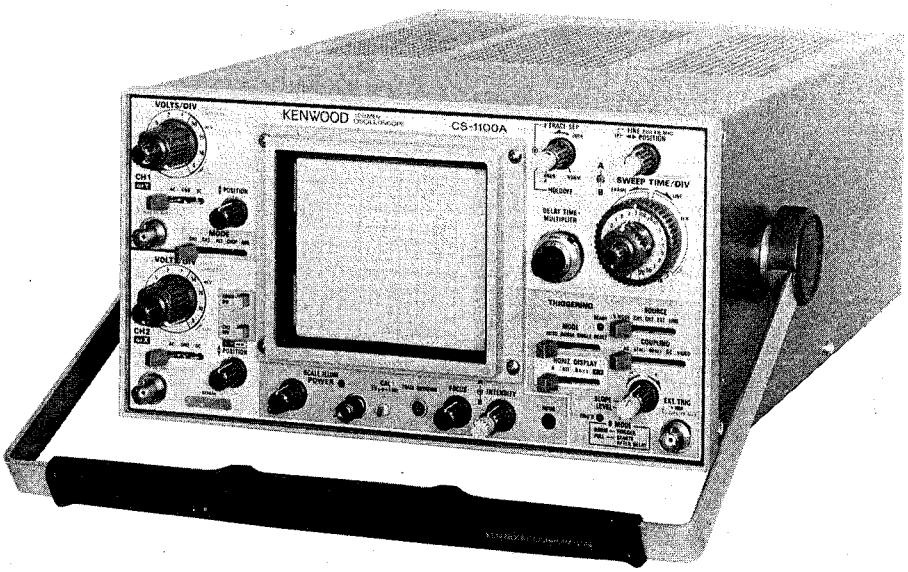
KENWOOD

100MHz DUAL TRACE OSCILLOSCOPE

CS-1100A

SERVICE MANUAL

KENWOOD CORPORATION



WARNING

1. The following instructions are for use by qualified personnel only. To avoid electric shock, do not perform servicing other than contained in the operating instructions unless you are qualified to do so.

2. High voltage up to 16000 volts DC is present when the oscilloscope is operating. Line voltage (90 to 264 VAC) is present on the power supply unit, on-off switch, and fuse holder, any time the oscilloscope is connected to an AC power source, even if turned off. Always observe caution whether the AC plug is removed from the AC power source. Contacting exposed high voltage could result in fatal electric shock.

CONTENTS

SAFETY 2
SPECIFICATIONS 3
CIRCUIT DESCRIPTION 6
ADJUSTMENT 10
TROUBLESHOOTING 18
PARTS LIST 26
SCHEMATIC DIAGRAM 41
P.C. BOARD 49
DISASSEMBLY 55
SEMICONDUCTORS 56

SAFETY

Before connecting the instrument to a power source, carefully read the following information, then verify that the proper power cord is used and the proper line fuse is installed for power source. If the power cord is not applied for specified voltage, there is always a certain amount of danger from electric shock.

Line voltage

This instrument operates using AC-power input voltages that 90 V to 264 V at frequencies from 45 Hz to 400 Hz.

Power cord

The ground wire of the 3-wire AC power plug places the chassis and housing of the oscilloscope at earth ground. Do not attempt to defeat the ground wire connection or float the oscilloscope; to do so may pose a great safety hazard. The appropriate power cord is supplied by an option that is specified when the instrument is ordered.

The optional power cords are shown as follows in Fig. 1.

Line fuse

The fuse holder is located on the rear panel and contains the line fuse. Verify that the proper fuse is installed by replacing the line fuse.

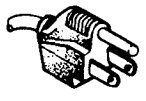
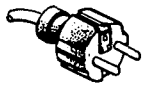
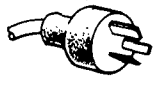
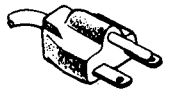
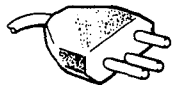
Plug configuration	Power cord and plug type	Factory installed *instrument* fuse	Line cord plug fuse	Parts No. for power cord
	North American 120 volt/60 Hz Rated 15 amp (12 amp max; NEC)	1.2 A, 250 V Fast blow AGC/3AG	None	E30-1820-05
	Universal Europe 220 volt/50 Hz Rated 16 amp	1.2 A, 250 V Fast blow 5×20 mm	None	E30-1819-05
	U.K. 240 volt/50 Hz Rated 13 amp	1.2 A, 250 V Fast blow 5×20 mm	1.2 A Type C	
	Australian 240 volt/50 Hz Rated 10 amp	1.2 A, 250 V Fast blow 5×20 mm	None	E30-1821-05
	North American 240 volt/60 Hz Rated 15 amp (12 amp max; NEC)	1.2 A, 250 V Fast blow AGC/3AG	None	
	Switzerland 240 volt/50 Hz Rated 10 amp	1.2 A, 250 V Fast blow AGC/3AG 5×20 mm	None	

Fig. 1 Power Input Voltage Configuration

SPECIFICATIONS

CRT

Model:	150WTM31 150 mm Rectangular, with internal graticule
Acceleration Voltage:	16 kV
Display Area:	8×10 div (1 div=10 mm)

VERTICAL AXIS (CH1 and CH2)

Sensitivity:	5 mV/div to 5 V/div (×1 mode) 1 mV/div to 1 V/div (×5 mode)
Accuracy:	±3% (10~35°C) ±5% (0~50°C)
Attenuator:	10 steps, 5 mV/div to 5 V/div in 1-2-5 sequence Vernier control for fully adjustable sensitivity between steps
Input Impedance:	1 MΩ±2%, approx. 22pF
Frequency Response:	
×1 mode:	DC; DC to 100 MHz, −3 dB AC; 5Hz to 100MHz, −3dB
5V/div range and ×5 mode:	DC; DC to 50 MHz, −3 dB AC; 5 Hz to 50 MHz, −3dB
Risetime:	3.5 nsec or less (100 MHz)
Signal Delay Time:	Approx. 10 nsec on the CRT screen
Crosstalk	−40 dB or less
Operating Modes:	CH1; single trace CH2; single trace ADD; CH1+CH2 added as a single trace ALT; dual trace, alternating CHOP; dual trace, chopped
Chop Frequency:	Approx. 250 kHz
Channel Polarity:	Normal or inverted, channel 2 only inverted
Maximum Input Voltage:	500 Vp-p or 250 V (DC+AC peak)
Non-Distorted Maximum Amplitude:	More than 8 div (DC to 100 MHz)
Bandwidth Limiting:	Vertical system bandwidth with the 20 MHz BW push button switch pushed is approximately 20 MHz (−3 dB)

HORIZONTAL AXIS (Input thru CH2)

Operating Modes:	With HORIZ. DISPLAY switch, X-Y operation is selectable CH1; Y axis CH2; X axis
Sensitivity:	Same as vertical axis (CH2)
Accuracy:	Same as vertical axis (CH2)
Input Impedance:	Same as vertical axis (CH2)
Frequency Response	DC; DC to 5 MHz, −3 dB AC; 5 Hz to 5 MHz, −3 dB
X-Y Phase Difference:	3° or less at 100 kHz
Maximum Input Voltage:	Same as vertical axis (CH2)

SWEEP

Type:	A;	A sweep
	ALT;	A sweep (intensified for duration of B sweep) and B sweep (delayed sweep) alternating
	B DLYD;	Delayed sweep
	X-Y;	X-Y oscilloscope
Sweep Time:	A;	20 ns/div to 0.5 s/div in 23 ranges, in 1-2-5 sequence Vernier control provides fully adjustable sweep time between steps
	B;	20 ns/div to 50 ms/div in 20 ranges, in 1-2-5 sequence
Accuracy:		±3% (10~35°C) ±6% (0~50°C)
Sweep Magnification:		×10 (ten times) ±5% (10~35°C) ±7% (0~50°C)
Linearity:		±3% (on 20 ns/div to 0.5 s/div) ±5% (×10 MAG)
HOLDOFF:		Continuously variable from NORM to more than five times (MAX)
TRACE SEPARATION:		B sweep can be separated downward from A sweep up to approx. 4 divisions, continuously adjustable
Delay Method (B MODE):		Continuous delay (STARTS AFTER DELAY), Trigger delay (TRIGGER)
Delay Time:		From 200 nsec to 0.5 sec Available delay time is 0.2 to 10 times the A sweep time setting, continuously adjustable

SPECIFICATIONS

Time Difference Measurement Accuracy: ±2% (10~35°C)
±4% (0~50°C)

Delay Jitter: 1/20000 of ten times of A sweep time setting

TRIGGERING

Trigger Mode: AUTO, NORM, SINGLE

Trigger Source:
- V MODE; Trigger selected by vertical MODE switch
- CH1; Triggered by CH1 signal
- CH2; Triggered by CH2 signal
- EXT; Triggered by external trigger signal
- LINE; Triggered by line voltage

Coupling: AC, LF_{REJ}, HF_{REJ}, DC, VIDEO LINE sync (horizontal sync pulses) automatically selected at A sweep times of 50 μs/div to 20 ns/div and FRAME sync (vertical sync pulses)automatically selected at A sweep times of 0.5 s/div to 0.1 ms/div

Trigger Level: ±90° adjustable

Polarity: +/−

B Trigger Mode: STARTS AFTER DELAY, TRIGGERABLE AFTER DELAY

Trigger Sensitivity

COUPLING	FREQ. RANGE	MINIMUM SYNC AMPLITUDE	
		INT	EXT
DC	DC~50 MHz DC~100 MHz	1.0 div 1.5 div	100 mV 210 mV
AC	Same as for DC but with increased minimum level for below 20 Hz		
AC HF_{REJ}	Increased minimum level below 20 Hz and above 30 kHz		
AC LF_{REJ}	Increased minimum level below 30 kHz		
VIDEO	FRAME/LINE	0.5 div	50 mV

AUTO: Same as above specifications for above 50 Hz.

Table-1

External Trigger:
Input impedance: 1 MΩ, approx. 40 pF
Maximum Input Voltage: 250 V (DC+AC peak)

CALIBRATING VOLTAGE

Square wave, positive polarity, 1 V ±2%, 1 kHz ±3%

INTENSITY MODULATION

Sensitivity: TTL compatible positive voltage decreases brightness
Input Impedance: Approx. 10 kΩ
Usable Frequency Range: DC to 5 MHz
Maximum Input Voltage: 50 V (DC+AC peak)

VERTICAL AXIS SIGNAL OUTPUT (CH1 OUT)

Output Voltage: 50 mVp-p/div into 50 Ω load
Output Impedance: Approx. 50 Ω
Frequency Response: DC to 100 MHz, −3 dB into 50 Ω load (Unapplied ×5 GAIN mode)

POWER REQUIREMENT

Power Supply: 90 V~264 V
Line Frequency: 45 Hz~400 Hz
Power Consumption: Approx. 60 W (into 100 V, 50 Hz)

DIMENSIONS (W×H×D)

304(346)×160(173)×351(411) mm
( ) dimensions include protrusion from basic outline dimensions

WEIGHT: Approx. 8.8 kg

ENVIRONMENTAL

Within Specifications: 10°C to 35°C, 85% max. relative humidity
Full Operation: 0°C to 50°C, 90% max, relative humidity

STANDARD ACCESSORIES INCLUDED

Probe (PC-39)×2 ..... W03-2305-05
Attenuation 1/10
Input Impedance ..... 10 MΩ, 18pF or less
Instruction Manual B50-7644-00
AC Power Cord ..... Fig. 1

OPTIONAL ACCESSORIES

Accessory Bag (MC-78) Y87-1600-00
Probe Holder J21-2903-03
Service Manual B51-1063-00

SPECIFICATIONS

CRT 150WTM 31 SPECIFICATIONS

Screen and Shape

Dimensions;

Overall length;	310±7 mm (300±7 mm)
Face plate dimensions;	149±3 mm
Screen shape;	Rectangular flat face, internal graticule, metal back
Deflection and focusing system;	Electrostatic deflection, electrostatic focusing and post-deflection acceleration
Color;	Green
Persistence;	Medium short
Useful display area	Y axis.....80 mm X axis.....100 mm

Heating

Heater voltage	6.3 V
Heater current	95 mA

■ Circuit and ratings are subject to change without notice due to developments in technology.

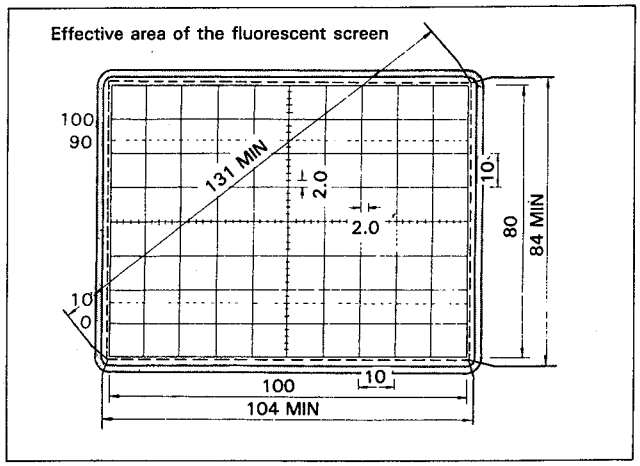


Fig. 2 Graticule

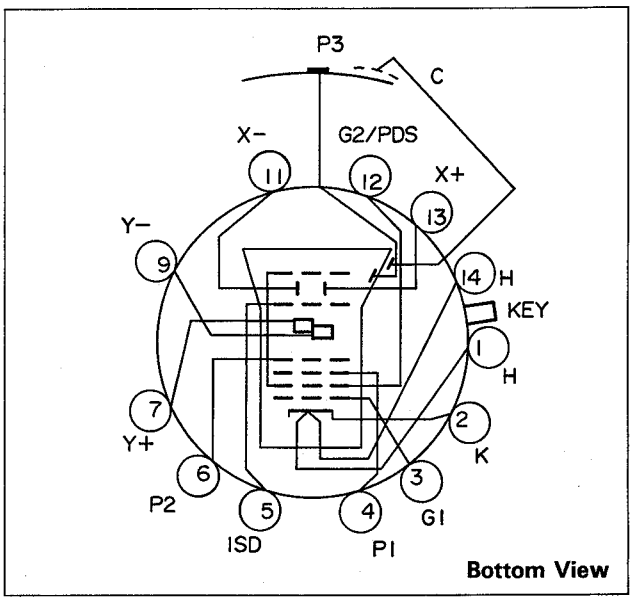


Fig. 3 150WTM31 Basing

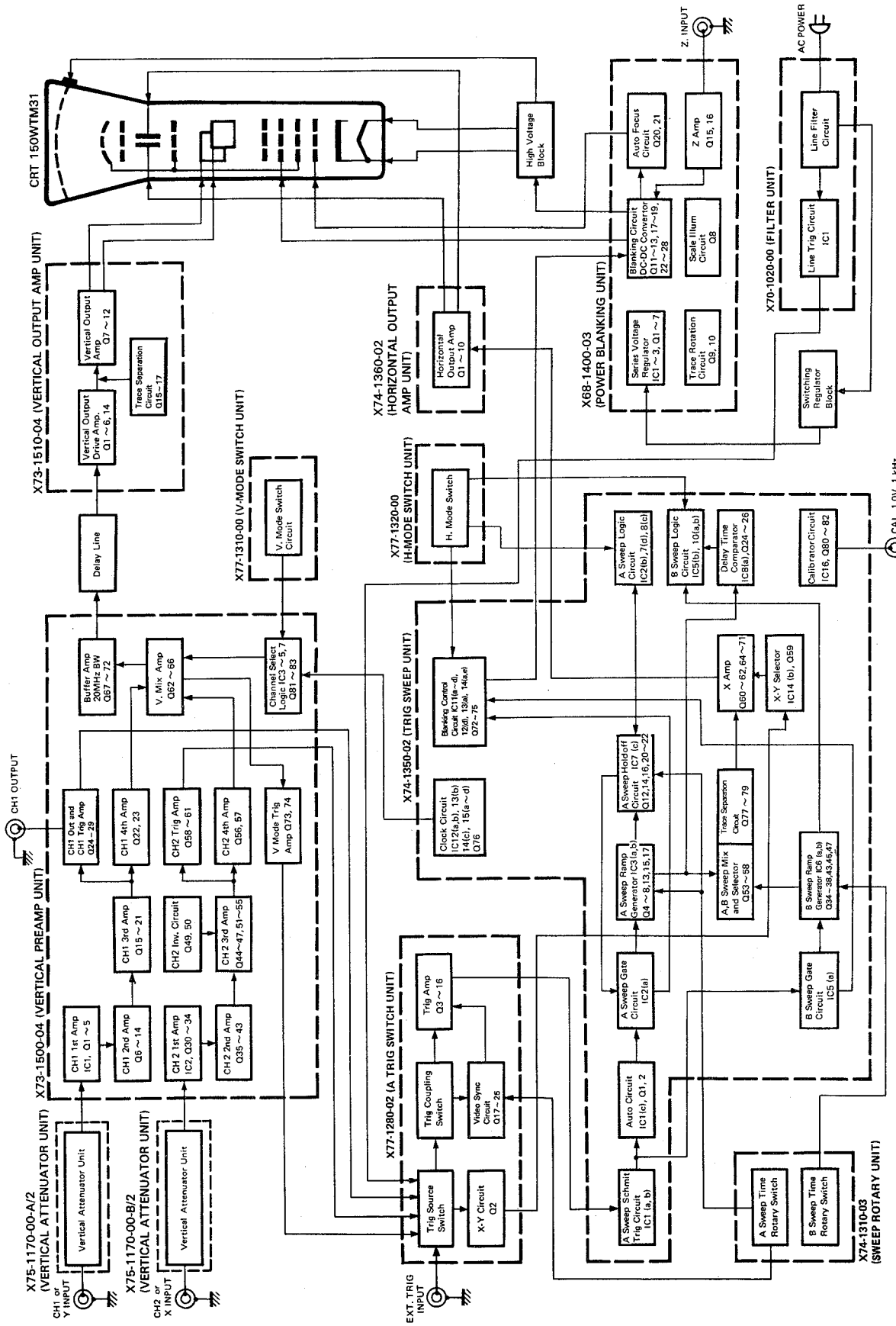

CRT 150WTM31
High Voltage Block
Z INPUT
AC POWER
X73-1510-04 (VERTICAL OUTPUT AMP UNIT)
Vertical Output Amp Q7 ~ 12
Trace Separation Circuit Q15~17
Vertical Output Drive Amp. Q1 ~ 6, 14
X74-1360-02 (HORIZONTAL OUTPUT AMP UNIT)
Horizontal Output Amp Q1 ~ 10
X68-1400-03 (POWER BLANKING UNIT)
Auto Focus Circuit Q20, 21
Z Amp Q15, 16
Blanking Circuit DC-DC Convertor Q11~13, 17~19, 22~28
Scale Illum Circuit Q8
Series Voltage Regulator IC1 ~ 3, Q1 ~ 7
Trace Rotation Circuit Q9, 10
X70-1020-00 (FILTER UNIT)
Line Filter Circuit
Line Trig Circuit IC1
Switching Regulator Block
X77-1310-00 (V-MODE SWITCH UNIT)
V. Mode Switch Circuit
X77-1320-00 (H-MODE SWITCH UNIT)
H. Mode Switch
Delay Line
A Sweep Logic Circuit IC2(b), 7(d), 8(c)
B Sweep Logic Circuit IC5(b), 10(a,b)
Delay Time Comparator IC8(a), Q24 ~ 26
Calibrator Circuit IC16, Q80 ~ 82
CAL. 1.0V, 1 kHz
Buffer Amp 20MHz BW Q67 ~ 72
V. Mix Amp Q62 ~ 66
Channel Select Logic IC3 ~ 5, 7 Q81 ~ 83
X74-1350-02 (TRIG SWEEP UNIT)
Blanking Control Circuit IC1(a~d), 12(d), 13(a), 14(a,d) Q72~75
X Amp Q60 ~ 62, 64 ~ 71
X-Y Selector IC14 (b), Q59
CH1 OUTPUT
CH1 Out and CH1 Trig Amp Q24 ~ 29
CH1 4th Amp Q22, 23
CH2 Trig Amp Q58 ~ 61
CH2 4th Amp Q56, 57
V Mode Trig Amp Q73, 74
Clock Circuit IC1(2(a,b), 13(b) 14(c), 15(a~d) Q76
A Sweep Holdoff Circuit IC7 (c) Q12,14,16,20~22
Trace Separation Circuit Q77 ~ 79
X75-1500-04 (VERTICAL PREAMP UNIT)
CH1 1st Amp IC1, Q1 ~ 5
CH1 2nd Amp Q6 ~ 14
CH1 3rd Amp Q15 ~ 21
CH2 Inv. Circuit Q49, 50
CH2 3rd Amp Q44~47, 51~55
CH2 1st Amp IC2, Q30 ~ 34
CH2 2nd Amp Q35 ~ 43
A Sweep Ramp Generator IC3 (a,b) Q4 ~ 8, 13, 15, 17
A,B Sweep Mix and Selector Q53 ~ 58
B Sweep Ramp Generator IC6 (a,b) Q34 ~ 38, 43, 45, 47
X77-1280-02 (A TRIG SWITCH UNIT)
Trig Amp Q3 ~ 16
Trig Coupling Switch
Video Sync Circuit Q17 ~ 25
A Sweep Gate Circuit IC2(a)
Auto Circuit IC1(c), Q1, 2
B Sweep Gate Circuit IC5 (a)
Trig Source Switch
X-Y Circuit Q2
A Sweep Schmit Trig Circuit IC1 (a, b)
A Sweep Time Rotary Switch
B Sweep Time Rotary Switch
X74-1310-03 (SWEEP ROTARY UNIT)
X75-1170-00-A/2 (VERTICAL ATTENUATOR UNIT)
Vertical Attenuator Unit
CH1 or Y INPUT
X75-1170-00-B/2 (VERTICAL ATTENUATOR UNIT)
Vertical Attenuator Unit
CH2 or X INPUT
EXT. TRIG INPUT

Fig. 4 BLOCK DIAGRAM

CIRCUIT DESCRIPTION

VERTICAL ATTENUATOR UNIT

The input attenuator consists of four stages. The first stage attenuates to 1/100, the second stage to 1/10, and the third stage to 1/2 and 1/5. The attenuator output signal passes through the head amp, and is attenuated to 1/1 (at 5 mV/div) or 1/2 (at 10 mV/div to 5 V/div) by the fourth stage with the low impedance. These attenuations are combined to provide one of 10 point input attenuations in 1-2-5 sequence.

The attenuator is composed of only resistors, capacitors and inductors and is not that type which varies gain of an amplifier. For this reason, it is not necessary to adjust step attenuator balance.

Frequency response is good because no 1/1000 attenuator is used. The same attenuator is used respectively in channels 1 and 2.

VERTICAL PREAMPLIFIER

The CS-1100A incorporates two preamplifiers to permit two-channel operation.

The first-stage of channel 1 is a low-drift, wide-band amplifier that composed of a single-ended transistor amplifier (Q1-5) of good frequency response to which DC feedback is applied by a low-offset, lowdrift operational amplifier (IC1).

The amplifiers following the first-stage one are differential ones. In the second stage, gain is varied for ×5 GAIN operation by transistor switches Q13, 14.

The third-stage amplifier includes the vertical position control. Q17 is the constant-current source which keeps the average output voltage of this stage fixed independently of the vertical position control setting. For channel 2, CH2 INV operation is performed when transistor switches Q49, 50 invert phase.

Q24, 25 is a trigger amplifier which delivers signal to the A-trigger switch board via buffer amplifier Q27 and Q29 of 50-ohm output impedance. Only in channel 1, CH1 OUT signal is delivered to the rear panel via Q26 and Q28.

The fourth-stage amplifier forms a cascode amplifier together with mixer amplifier Q62, 63.

The circuitry of channel 2 is the same as of channel 1.

Two signals of channels 1 and 2 are delivered to the emitters of Q62, 63 after being selected with diode switches D7-10 and D21-24.

Q67, 68 are a buffer amplifier for matching with the delay line. Having a good CMRR, it delivers balanced output to the delay line so that waveform distortion in the delay line is reduced.

Q73, 74 are a trigger amplifier which sends the output of the mixer amplifier to the A-trigger switch board as the V. MODE trigger source.

Q64 is a switching transistor for selecting load resistor in ADD mode.

Q69-72 form the 20 MHz bandwidth circuit which determines the frequency response of the vertical axis as 20 MHz (−3 dB).

Signals of channel 1 and 2 are suitably selected by the logic circuit of IC3-5 and IC7 for a combination of vertical and horizontal modes.

VERTICAL OUTPUT AMPLIFIER

The output signal of the delay line comes to the vertical output amplifier. Q1-4 are a cascode-connected differential amplifier. Q14 is a bias circuit of constant current. Q7-12 are the final output amplifier. Q11, 12 are mounted directly on the chassis with aluminum fins fitted to them. This design has improved efficiency of heat dissipation very much. Variable capacitance diodes D2, 3 and thermistor TH1 connected to the emitters of Q7-10 form the temperature compensation circuit that keeps square wave characteristics and frequency response unchanged at varying temperature.

Q15-17 form the trace separation circuit.

A-TRIGGER SWITCH CIRCUIT

Signals of CH1, CH2, V. MODE, external, and LINE trigger come to the A-trigger switch circuit. S1 is the trigger source selection switch and S2 is the trigger coupling selection switch.

Q3 is a dual FET which eliminates drift due to temperature changes even during DC synchronization. Q4, 5 form an emitter follower to lower drive impedance of the next stage. Q6, 7 are a feedback amplifier and improve CMRR of positive and negative trigger signals. Q10-15 are a cascode amplifier which selects polarity of the trigger signal.

Q17-25 are the VIDEO synchronization circuit where Q17-19 select polarity of the trigger signal and Q21, 22 shape the trigger signal. Q24 connecting to the SWEEP TIME/DIV switch separates vertical and horizontal sync-signals.

Q16 receives trigger signal from Q10-15 or Q25 and sends it with the output impedance of 50 ohms to the trigger sweep unit.

Q2 picks up the trigger signal of CH2 and sends the X-signal of X-Y operation to the trigger sweep unit.

ROTARY SWITCH CIRCUIT

Part of the sweep circuit is mounted on a separate board. It includes the rotary switch of sweep time selection, resistors, and resistors of the hold-off circuit.

TRIGGER SWEEP CIRCUIT

The sweep circuit uses a constant-current integration circuit which produces sawtooth waves by charging a capacitor with a constant current. Q13, 15, and Q17 are the transistors which switch over capacitors determining A-sweep time. Q43, 45, and Q47 work for B-sweep as in A-sweep.

Q12, 14, and Q16 are the transistors which switch hold-off capacitors of A-sweep.
The voltage supplied from the voltage regulator is converted to a constant-current source by the constant-voltage setting circuit of IC3a and Q7 and resistors which the rotary switch selects. As the current charges a capacitor determining sweep time, its terminal voltage rises. The voltage is delivered to a buffer amplifier (Q18, 19) of high input impedance. When the output of the amplifier reaches a fixed level, it turns on IC7d, resets flip-flop IC2b, and sets IC2a. The output of IC2a turns on Q6 to short the capacitor determining sweep time so that the terminal voltage of the capacitor falls. On the other hand, the constant-current circuit composed of Q20 charges one of the hold-off capacitors C12, 16, and C20. The terminal voltage of the capacitor rises gradually and, as it reaches a certain level, Q22 turns on. The Q22's output turns on the Schmitt trigger of IC7c and releases IC2b from set state. The IC2b's output, in turn, resets IC2a so that sweeping restarts.
The trigger signal then triggers IC2a via IC1a and IC1b and releases the flip-flop from set state which are set so that sweeping starts synchronously with the trigger signal.
IC1a and IC1b make up a Schmitt trigger.
The trigger signal shaped by IC1a and IC1b comes to IC1c, Q1, and Q2. When the trigger signal is applied, gate IC1d is closed and IC2a operates as a master-slave flip-flop. When no trigger signal is applied, gate IC1d is open and IC2a works as an R-S flip-flop. This is the auto-free-run circuit.
Q24-26 form the level detector circuit for delayed sweep. When the voltage level set with DELAY TIME MULTIPLIER has been reached, Q24 turns on and triggers gate IC8a. IC8a and IC10b form a logical differentiation circuit which generates pulse of a fixed width. The pulse sets IC5b to start B-sweep. The circuitry for B-sweep is almost the same as for A-sweep but that three slow sweep ranges are not provided. The trigger signal of B-sweep is supplied from IC1a and IC1b as in A-sweep.
It is possible to convert gate IC12c from a triggerable master-slave flip-flop over to an R-S flip-flop with the B STARTS AFTER DELAY switch and to start sweeping at the voltage level set with DELAY TIME MULTIPLIER.
Q53 adjusts horizontal position of A-sweep and Q54 that of B-sweep. Q55-58 work with HORIZ DISPLAY.
The waveforms of A- and B-sweeps are composed at the collectors of Q55 and Q58. The X-Y signal is also composed at the same point after it passes Q59. Q62, 63 improve CMRR of the signal which has passed Q60 before delivering it to the next stage. Q69 selects ×1 or ×10 for Q64, 65 and Q68 for Q66, 67. Q70, 71 converts impedance to 50 ohms. The signal then comes to the horizontal final amplifier.
Q77-79 form the TRACE SEPARATION circuit. Two bias voltages are generated from the A/B-sweep selection signal and supplied to the vertical output amplifier.
IC8d generates reset pulse during single operation.
IC13a, 14a, and IC14e generate a blanking control signal to display the horizontal axis. The signal is combined with sweep signal and chop switching signal in IC11a-11d and IC12d, and is converted impedance by Q72-75 before coming to the blanking circuit.
The channel selection signal during ALT and CHOP of vertical mode is generated by IC12a, IC12b, IC13b, IC14c, IC15a-15d, and Q76.
IC12a, 12b are the chop oscillator. It is turned on and off with the signals coming from the vertical axis mode logic and the horizontal mode switch unit. When it is not oscillating, it receives signal from Q76 to output an alternate signal. Outputs of IC12a, 12b are cut off during vertical axis single trace mode and are output on otherwise. The output of IC 15d is supplied to the vertical preamplifier to function as the chop and alternate signals.

CALIBRATION VOLTAGE GENERATOR

Q80, 81 form a multivibrator and Q82 outputs a calibration voltage with low impedance. IC 16 supplies the circuit with regulated power.

HORIZONTAL OUTPUT AMPLIFIER

Q1, 2 amplify the sweep signal delivered from the trigger sweep circuit. The output of Q1, 2 passes the emitter follower Q3, 4 which converts impedance then drives Q5, 6. Q7, 8 form a constant-current circuit which is the DC load of Q5, 6 and AC-peaked by C11, 12. Q9, 10 compose the auto-bias circuit which sets bias of the output stage automatically.

VERTICAL MODE SWITCH CIRCUIT

This circuit controls the vertical preamplifier. S1a, S1b, S2a, and S2b send signal to the vertical axis mode logic. S3a and S3b control the CH2 INV circuit.
VR1 and VR2 are respectively the vertical position controls of channels 1 and 2.

HORIZONTAL MODE SWITCH CIRCUIT

S1a and S1b select control signal for displaying the horizontal axis and send it to the trigger sweep circuit. S2a and S2b select trigger mode control signal and send it to the trigger sweep circuit.
VR1 adjusts astigmatism of the CRT.

CIRCUIT DESCRIPTION

SWITCHING POWER SUPPLY UNIT

The CS-1100A incorporates a switching power supply which is compact, lightweight, and efficient. Power consumption is reduced to 60 W thanks to elimination of power loss which the ordinary series regulator type power supply with a power transformer suffers.
The regulator rectifies 90-264 V and smoothes to DC with the aid of capacitors. A power transistor switches the DC and converts to AC which drives a converter transformer. The transformer has six secondary windings and six AC outputs are rectified and smoothed separately to supply the power blanking unit with DC voltages. The output of the control winding is compared with a reference voltage and is amplified by an error amplifier whose output, isolated from the primary voltage, controls the base of the power transistor to stabilize the secondary voltages.

POWER BLANKING UNIT

Five out of six output voltages of the switching power supply unit are regulated again by a series regulator. Q1 and Q3-6 are control transistors. IC1a, 1b, 2a, and 2b compose the error amplifier. IC3 supplies the reference voltage to the error amplifier. A regulator which divides voltage with resistors stabilizes +20 V as its stability need not be so high.
The DC-DC converter for high voltage is the same as the ordinary one. Q24-26 are an error amplifier and Q28 is a control transistor. The CS-1100A permits to vary intensity of A-and B-sweeps independently as Q11-13 work for it. Q15, 16 compose the external intensity modulation circuit and intensity is low at "H" (TTL level).
The signals are composed at the base of Q17 to drive Q18. Q19 is the DC load of Q18 and AC-peaked by C25.
Q20, 21 are an auto-focus circuit which applies a signal whose phase is inverse to the blanking waveform to the focusing electrode of the CRT.
Q22, 23 form a DC regeneration circuit for the blanking and focus circuits. It is a differential amplifier which sends isolated signals to the circuits.
Q8 is the transistor for illuminating the scale. Q9, 10 are the transistors for trace rotation.

FILTER UNIT

L1 and C1-3 compose the line filter that keeps out noises included in supply power and prevents internal noises from going out to the power line.
IC 1 is a photocoupler which provides the trigger source for LINE trigger.

HIGH VOLTAGE BLOCK

The final acceleration voltage is 14 kV and the high voltage block is so sealed with resin that the inside is not accessible (otherwise it would be not only dangerous but also electrical requirements might not be met if leakage occurs). The high voltage block includes a DC-DC converter and the rectification circuit of 1.7 kV supplied to the cathode. The outputs are −1.7 kV DC, 6.3 V AC, and 14 kV which is sent to the anode cap. The DC voltages except 14 kV are 1/2 to 1/3 as high as those appearing in other KENWOOD oscilloscopes, and shock hazard is prevented.

ADJUSTMENT

To obtain the best performance, periodically accurately calibrate the unit.
Sometimes, only one mode need be calibrated, while at other times, all modes should be calibrated.
When one mode is calibrated, it must be noted that the other modes may be affected. When calibrating all modes, perform the calibration in the specified sequence.
The following calibration requires an accurate measuring instrument and an insulated adjusting flat blade screwdriver. If they are not available, contact your dealer.
For optimum adjustment, turn the power on and warm up the scope sufficiently (more than 30 minutes) before staring.

NOTE:
Calibrate the unit under the following condition.
Temperature: 10~35°C
Humidity: Less than 85%

POWER SUPPLY VOLTAGE

Before calibrating the unit, check the power supply voltage. (90~264 V.)

TEST EQUIPMENT REQUIRED

The following instrument or their equivalent should be used for making adjustments.

Test Equipment	Model	Minimum Specification
Digital Multi-Meter	DL-720 (KENWOOD)	Impedance: More than 10 MΩ, Measuring range: 0.01 V to 199 V
Sine-Wave Generator	SG-502 (Tektronix)	Frequency: 10 Hz to 10 MHz, constant voltage over tuning range
Sine-Wave Generator	SG-503 (Tektronix)	Frequency: 50kHz to 100MHz, Output impedance: 50 Ω, constant voltage over tuning range
Square-Wave Generator	PG-506 (Tektronix)	Output signal: 1 kHz, Amplitude: 10 mVp-p to 10 Vp-p, Accuracy: within ±1%, Rise time: 35ns or less (1 MHz, 1ns or less)
Q Meter	4343B (YHP)	—
Color Pattern Generator	CG-911A (KENWOOD)	—
Oscilloscope	475A (Tektronix)	Sensitivity: More than 5 mV Frequency response: More than 250 MHz
Time-Marker Generator	TG-501 (Tektronix)	Time mark: 0.5s to 0.1 μs repetitive waveform, Accuracy: within 0.1%
High-Voltage Probe	—	Input Impedance: 1000 MΩ
Termination	TA-57 (KENWOOD)	Impedance: 50 Ω
Attenuator	011-0059-02 (Tektronix)	−20 dB attenuation (50 Ω)
Power Meter	2041 (YEW)	—
Auto transformer (variable)	SD-265 (Matsunaga)	—
Current Probe	P6302 AM-503 (Tektronix)	—
Frequency Counter	FC-756 (KENWOOD)	—

Table-2

PREPARATION FOR ADJUSTMENT

Control Setting

The control settings listed below must be used for each adjustment procedure. Exceptions to these settings will be noted as they occur. After completing a adjustment, return the controls to the following settings.

Power Section

POWER	ON

CRT Control Section

A INTENSITY	12 o'clock position
B INTENSITY	12 o'clock position
FOCUS and ASTIG	Optimum position
SCALE ILLUM	Arbitrary position

Vertical Section

VARIABLE (CH1 and CH2)	CAL
▲▼POSITION (CH1 and CH2)	12 o'clock position
AC-GND-DC (CH1 and CH2)	DC
VOLTS/DIV (CH1 and CH2)	5 mV/DIV

Horizontal Sweep Section

A SWEEP TIME/DIV	0.1ms/DIV
B SWEEP TIME/DIV	0.1ms/DIV
A VARIABLE	CAL
DELAY TIME MULT	0.20 position
▲▼ TRACE SEP.	Fully CW
HOLDOFF	NORM
B ENDS A	OFF
◀▶ POSITION	12 o'clock position
FINE PULL×10 MAG	12 o'clock position (×10 MAG OFF)

TRIG Section

SOURCE	V MODE
COUPLING	AC
LEVEL	12 o'clock position
SLOPE	+

Mode Section

Vertical MODE	CH1
20 MHz BW	OFF
CH2 INV	OFF
TRIG MODE	AUTO
HORIZ DISPLAY	A

ADJUSTMENT

POWER AND CRT ADJUSTMENT

Check of Power Supply

Connect a DC voltmeter to measure the voltage at P27(X68-1400) as shown in table 3.

Pin no.	1	2	3	4	5	6	7	8
Voltage(V)	+120 ±2	+55 ±1	+20			+5.2 ±0.1	+10	−10

Table-3

−1.7 kV Adjustment

Connect a DC voltmeter to measure the voltage at H.V. TP (X68-1400) using a high voltage probe and adjust VR3 (X68-1400) for −1.700 kV reading on the meter. (−1.700 kV ~ −1.705 kV)

ASTIG and FOCUS Coarse Adjustment

1. Set the controls and switches at follows;
   HORIZ DISPLAY: X-Y CH1, CH2 AC-GND-DC: GND
   20 MHz BW: on A INTENSITY: 12 to 3 o'clock
2. Operate ▲▼ POSITION controls for CH 1 and CH 2 to position the spot in the center of the CRT screen.
3. Adjust the FOCUS and ASTIG controls for the sharpest,roundest spot.

A INTENSITY Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: X-Y CH1, CH2 AC-GND-DC: GND
   20 MHz BW: on
2. Adjust VR1(X68-1400) so that the spot disappears when the A INTENSITY control setting is reduced to 8:30 o'clock position.
3. Clockwise rotation should increase brightness of the spot and counterclockwise rotation should decrease brightness of the spot. Fully counterclockwise should disappear the spot.

B INTENSITY Check

1. Set the controls and switches as follows;
   HORIZ DISPLAY: ALT Vertical MODE: CH1
   TRIG MODE: AUTO
   B MODE: pull STARTS AFTER DELAY
   CH1,CH2 AC-GND-DC: AC B SWEEP TIME/DIV: 0.1 ms
2. Check that the clockwise rotation should increase brightness of the trace and counterclockwise should decrease brightness of the trace. Fully counterclockwise should disappear the trace.

Blanking Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   TRIG MODE: AUTO SOURCE: V MODE
   COUPLING: AC A INTENSITY: Fully CW
   CH1 AC-GND-DC: AC
   A SWEEP TIME/DIV: 0.2 μs
2. Apply a 1MHz sine wave signal to CH1 INPUT jack and operate ▲▼POSITION, ◀▶POSITION and CH1 VOLTS/DIV controls to display a waveform of 6 divisions vertical amplitude.
3. Adjust TC2 (X68-1400) so that there is no unevenness in intensity of trace at the waveform starting point and there is no retrace.

Z AXIS Input Blanking Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   TRIG MODE: AUTO SOURCE: V MODE
   COUPLING: AC CH1 VOLTS/DIV: 1 V
   CH1 AC-GND-DC: AC A SWEEP TIME/DIV: 0.5μs
2. Apply a 1MHz 5 Vp-p sine wave signal to CH1 and Z INPUT jacks to display a waveform of 5 divisions vertical amplitude.
3. Turn the A INTENSITY control to CCW so that the dark and bright area of the sine waveform is symmetrical to the peak point.
4. Adjust TC1 (X68-1400) for unblanking symmetry; that is; so the beginning and ending of the visible portion occur at equal vertical points.
   If symmetry cannot be achieved, adjust for maximum length of brightness on waveform's falling edge.

Auto Focus Level Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A
   CH1 AC-GND-DC: GND
   A INTENSITY: Fully CW TRIG MODE: AUTO
   Vertical MODE: CH1 SOURCE: V MODE
   A SWEEP TIME/DIV: 20 μs HOLDOFF: NORM
2. Set the oscilloscope (475A) for the vertical axis sensitivity at 2 V/div.
3. Observe the waveform of AUTO FOCUS pattern with the probe (1/10) and adjust VR2 (X68-1400) so that DC level of the top of the square wave is approx. 90 V.

Auto Focus Wave forming Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A
   CH1 AC-GND-DC: GND
   A INTENSITY: Fully CW TRIG MODE: AUTO
   Vertical MODE: CH1 SOURCE: V MODE
   A SWEEP TIME/DIV: 20 μs HOLDOFF: NORM
2. Adjust TC3 (X68-1400) to display an ideal waveform at above-mentioned point.

ASTIG and FOCUS Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: X-Y CH1,CH2 AC-GND-DC: GND
   A INTENSITY: 12 o'clock
2. Operate ▲▼ POSITION control for CH1 and CH2 to display a spot on the CRT screen.
3. Adjust ASTIG and FOCUS controls for the sharpest, roundest spot when centering the ASTIG and FOCUS controls.

Trace Rotation Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   TRIG MODE: AUTO CH1 AC-GND-DC: GND
   A INTENSITY: 12 o'clock

2. Use CH1 ▲▼ POSITION control as required to position the trace along a horizontal line of the graticule scale.
3. Adjust TRACE ROTATION control so trace is parallel with the reference line on the graticule scale.

CRT Centering Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   TRIG MODE: AUTO CH1 AC-GND-DC: GND
   A INTENSITY: 12 o'clock
2. Short the short circuit (TP3) on the vertical preamp unit (X73-1500).
3. Adjust VR3 (X73-1510) to center the trace vertically.

VERTICAL AXIS ADJUSTMENT

CH1 DC Balance Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   TRIG MODE: AUTO CH1 AC-GND-DC: GND
   CH1 VOLTS/DIV: 5 mV
   CH1 PULL×5 GAIN: PULL
2. Rotate the CH1 VARIABLE control to fully counterclockwise position.
3. Operate the ▲▼ POSITION control to display a trace on the horizontal center graticule line.
4. Rotate the CH1 VARIABLE control to CAL and adjust VR2 (X73-1500) to align the trace on the horizontal center graticule line.
5. Repeat the above procedure.

CH2 DC Balance Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH2
   TRIG MODE: AUTO CH2 AC-GND-DC: GND
   CH2 VOLTS/DIV: 5 mV
   CH2 PULL×5 GAIN: PULL
2. Same with the adjustment of CH1 DC Balance adjustment, adjusting VR12 (X73-1500).

CH1 Waveforming in Low Range

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   TRIG MODE: AUTO SOURCE: V MODE
   CH1 AC-GND-DC: DC CH1 VOLTS/DIV: 5 mV
   CH1 VARIABLE: CAL A SWEEP TIME/DIV: 0.2 ms
2. Apply a 1kHz square wave signal to CH1 INPUT jack to display a waveform of 6 divisions vertical amplitude.
3. Adjust VR1 (X73-1500) to shape the square waveform in the low range.

CH2 Waveforming in Low Range

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH2
   TRIG MODE: AUTO SOURCE: V MODE
   CH2 AC-GND-DC: DC CH2 VOLTS/DIV: 5 mV
   CH2 VARIABLE: CAL A SWEEP TIME/DIV: 0.2 ms
2. Perform the same procedure as described above to make adjustment, adjusting VR11 (X73-1500).

CH1 Gain Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   TRIG MODE: AUTO SOURCE: V MODE
   CH1 AC-GND-DC: DC CH1 VOLTS/DIV: 10 mV
   CH1 VARIABLE: CAL 20 MHz BW: on
   A SWEEP TIME/DIV: 0.2 ms
2. Apply a 1kHz, 50 mVp-p square wave signal to both CH1 and CH2 INPUT jacks.
3. Select the vertical MODE switch to CH1 and operate the ▲▼ POSITION control to display a waveform on the center of the CRT screen.
4. Synchronize by operating the trigger LEVEL control.
5. Adjust VR7 (X73-1500) to display a waveform of 5 divisions vertical amplitude.
   (Reference)
   Methode of calculation of sensitivity error.

$$\text{Sensitivity error} = \frac{a-b}{b} \times 100\%$$

a = CRT screen amplitude

$$b = \frac{\text{Input signal voltage}}{\text{VOLTS/DIV setting}}$$

Example;
CRT screen amplitude; 4.2 div
Input signal; 20 mVp-p, 1 kHz square wave
VOLTS/DIV; 5 mV

$$\text{Sensitivity error} = \frac{4.2\ \text{div} - 20\ \text{mV}/5\ \text{mV}}{20\ \text{mV}/5\ \text{mV}} \times 100 = 5\%$$

CH2 Gain Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH2
   TRIG MODE: AUTO SOURCE: V MODE
   CH2 AC-GND-DC: DC CH2 VOLTS/DIV: 10 mV
   CH2 VARIABLE: CAL 20MHz BW: on
   A SWEEP TIME/DIV: 0.2 ms
2. Rotate the VOLTS/DIV control to 10 mV and perform the same procedure above to make adjustment, adjusting VR18 (X73-1500)

<**Check**>

1. Select the vertical MODE switch to ALT and rotate the VOLTS/DIV control. Apply a 1 kHz, 50 mVp-p square wave to both CH1 and CH2 INPUT jacks. Make sure that CH1 and CH2 have the same amplitude.
2. Select the vertical MODE switch to ADD and SOURCE to CH1 (CH2) and press the CH2 INV pushbutton switch . Operate ▲▼ POSITION controls (CH1 and CH2) to display a single trace on the center of the CRT screen.
   If a single and straight trace cannot be obtained, adjust VR7 and VR18 again.

ADJUSTMENT

CH1 and CH2 ▲▼ POSITION Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: ALT
   TRIG MODE: AUTO CH1,CH2 VOLTS/DIV: 5 mV
   CH1,CH2 AC-GND-DC: GND
   CH1,CH2 ▲▼ POSITION: 12 o'clock
   A SWEEP TIME/DIV: 0.2 ms
2. Adjust VR6 and VR16 (X73-1500) to align with CH1 trace and CH2 trace on the horizontal center graticule line.

<**Check**>

When the ▲▼ POSITION controls (CH1 and CH2) are rotated to maximum clockwise, the trace should move upward more than 4 divisions and to maximum counterclockwise,the trace should move downward more than 4 divisions.

CH2 INVERT position

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: ALT
   TRIG MODE: AUTO CH1, CH2 VOLTS/DIV: 5 mV
   CH1, CH2 AC-GND-DC: GND
   CH1,CH2 ▲▼ POSITION: 12 o'clock
   A SWEEP TIME/DIV: 0.2 ms
2. Press the CH2 INV pushbutton switch and adjust VR17 (X73-1500) to display a trace to its position at CH2 NORM.

<**Check**>

1. Press the CH2 INV switch and rotate the CH2 ▲▼ POSITION control fully clockwise and see if the trace move more than 4 divisions upward and it moves more than 4 divisions downward when the control is rotated fully counterclockwise.

CH1 and CH2×5 Gain Adjustment

1. HORIZ DISPLAY: A Vertical MODE: ALT
   TRIG MODE: AUTO
   CH1,CH2 VOLTS/DIV: 10 mV
   CH1,CH2 PULL×5 GAIN: PULL
   CH1,CH2 AC-GND-DC: DC
   CH1,CH2 VARIABLE: CAL
   A SWEEP TIME/DIV: 0.2 ms 20 MHz BW: on
2. Apply a 1kHz 10 mVp-p square wave signal to CH1 INPUT jack and adjust VR4 (VR14 for CH2) to display a waveform of 5 divisions vertical amplitude.
3. Apply a same signal to CH2 and make the similar adjustment.

CH1 and CH2 ×5 Gain Position Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A TRIG MODE: AUTO
   Vertical MODE: ALT CH1, CH2 VOLTS/DIV: 10 mV
   CH1,CH2 PULL×5 GAIN: PULL
   CH1,CH2 AC-GND-DC: GND
   CH1,CH2 ▲▼ POSITION: 12 o'clock
   A SWEEP TIME/DIV: 0.2 ms
2. Adjust VR5 and VR15 (X73-1500) to align with CH1 trace and CH2 trace on the horizontal center graticule line.

CH1 and CH2 Trigger DC Level Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CHOP
   CH1,CH2 AC-GND-DC: GND TRIG MODE: AUTO
2. Operate the CH1 and CH2 ▲▼ POSITION controls to align the trace with each other on the center of the CRT screen.
3. Adjust VR9 for CH1 and VR19 for CH2 (X73-1500) so that the voltage at all the check points may be zero (−0.008 ~ +0.008 V).

Item	Adj. control	Check point
CH1 trig DC level	VR9	P15 (X73-1500)
CH2 trig DC level	VR19	P16 (X73-1500)

Table-4

V MODE Trigger DC Level Adjustment

1. Set the controls and switches as follows;
   Vertical MODE: CH1 CH1 AC-GND-DC: GND
2. Operate the CH1 ▲▼ POSITION control to align the trace with horizontal center graticule line.
3. Adjust VR20 (X73-1500) so that the voltage in the conductor of the connector P19 is zero (−0.008 ~ +0.008 V).

CH1 OUT Gain Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   TRIG MODE: AUTO CH1 AC-GND-DC: DC
   CH1 VOLTS/DIV: 10 mV CH1 VARIABLE: CAL
2. Set the vertical axis sensitivity of oscilloscope(475A) to 50 mV and input selector to DC position.
3. Connect the cable to CH1 OUT on the rear panel of CS-1100A and oscilloscope (475A) via the 50 Ω termination.
4. Apply a 1kHz 50 mVp-p square wave signal to CH1 INPUT jack and operate the oscillator output and ▲▼ POSITION control to display a waveform of 2.5 divisions vertical amplitude upward and downward from the horizontal center graticule line.
5. Adjust VR8 (X73-1500) to display waveform of 5 divisions vertical amplitude on the oscilloscope (475A).

Square wave Characteristics of CH1 20 mV Range Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   TRIG MODE: AUTO CH1 AC-GND-DC: DC
   CH1 VOLTS/DIV: 20 mV SOURCE: CH1
   COUPLING: AC SLOPE: +
   CH1 VARIABLE: CAL
2. Apply a 1kHz square wave signal to CH1 INPUT jack to display a waveform of 6 divisions vertical amplitude.
   <**Note**>
   Input terminal should be terminated to match the output impedance of the oscillator. When the output impedance is 50 Ω, terminate the 50 Ω termination.
3. Adjust TC1 (X73-1500) to shape the square waveform for the best flat top waveform.

ADJUSTMENT

Square wave Characteristics of CH2 20 mV Range Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH2
   TRIG MODE: AUTO SOURCE: V MODE
   CH2 AC-GND-DC: DC CH2 VOLTS/DIV: 20 mV
   CH2 VARIABLE: CAL SLOPE: +
2. Apply a 1kHz square wave signal to CH2 INPUT jack to display a waveform of 6 divisions vertical amplitude.
3. Adjust TC5 (X73-1500) to shape the square waveform for the best flat top waveform.

CH1 and CH2 Square wave Characteristics Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A CH1, CH2 AC-GND-DC: DC
   SOURCE: V MODE SWEEP TIME/DIV: 0.2 ms
   CH1, CH2 VARIABLE: CAL
2. I) Wave shaping
   Apply a 1 kHz square wave signal to both CH1 and CH2 INPUT jacks to display a waveform of 5 or 6 divisions vertical amplitude.
   Adjust the adj. control listed below to display a waveform for the best flat top waveform to that of the 10 mV range.
   II) Input capacity (22pF±3pF)
   Connect a Q-meter (4343B) to CH1 and CH2 INPUT jacks to be the same value of 10 mV range.

CH1 and CH2 reference range; 10 mV range

Sequence	Adjustment		Adj. control
1	20 mV range	Wave shape	TC5
2	50 mV range	Wave shape	TC7
3	20 mV range	Input cap.	TC6
4	50 mV range	Input cap.	TC8
5	0.1 V range	Wave shape	TC3
6	0.1 V range	Input cap.	TC4
7	1 V range	Wave shape	TC1
8	1 V range	Input cap.	TC2

Table-5 (S02-4508)

Square wave Characteristics of CH1 5 mV Range Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   TRIG MODE: AUTO CH1 AC-GND-DC: DC
   SOURCE: V MODE COUPLING: AC
2. Apply a 1MHz square wave signal to CH1 INPUT jack to display a waveform of 6 divisions vertical amplitude.
3. Adjust the adj. control listed below to display a waveform for the best flat top of the waveform.

Sequence	Adjustment	Adj. control	Unit No.
1	Mid and high frequency compensation	VR1	X73-1510
2	Peak top waveform compensation	VR2	X73-1510
3	Mid and high frequency compensation High frequency compensation	TC1 TC2	X73-1510
4	Ultra high frequency compensation	TC2	X73-1500
5	High frequency compensation	TC3	X73-1500

Table-6

Square wave Characteristics of CH2 5 mV Range Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH2
   TRIG MODE: AUTO CH2 AC-GND-DC: DC
   SOURCE: V MODE COUPLING: AC
2. Apply a 1 MHz square wave signal to CH2 INPUT jack to display a waveform of 6 divisions vertical amplitude.
3. Adjust the adj. control listed below to display a waveform for the best flat top of the waveform.

Sequence	Adjustment	Adj. control	Unit No.
1	Ultra high frequency compensation	TC6	X73-1500
2	High frequency compensation	TC7	X73-1500

Table-7

CH1 OUT Frequency Characteristics Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   SOURCE: V MODE CH1 AC-GND-DC: DC
   CH1 VOLTS/DIV: 5 mV TRIG MODE: AUTO
2. With the vertical axis sensitivity of 475A set to 50 mV, lead a 50 Ω coaxial it to CH1 INPUT jack of test oscilloscope (475A).
3. Apply a 50 kHz sine wave signal to CH1 INPUT jack to display a waveform of 6 divisions vertical amplitude on the test oscilloscope (475A).
4. When the frequency is varied to 100 MHz without changing the oscillator output, adjust TC4 (X73-1500) so that the vertical amplitude on the test oscilloscope (475A) is equivalent to that on the CS-1100A.

CAL Output Adjustment

1. Short circuit TP1 (X74-1350) and adjust VR17 (X74-1350) to read the voltage at CAL output terminal for 1.0 V on the voltmeter.
2. Set the vertical sensitivity of test oscilloscope (475A) to 20 mV and sweep time to 0.2 ms.

3. Connect a probe from the calibration voltage output terminal (CAL) of CS-1100A and connect it to CH1 INPUT jack of the test oscilloscope (475A).
4. Adjust VR16 (X74-1350) to read the frequency for 1kHz.

<Check>
Frequency: within 1 kHz±3%
Output voltage: within 1.0 Vp-p±2%
Duty ratio: within (50±2.5)%

HORIZONTAL SWEEP ADJUSTMENT

A Sweep Time Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   SOURCE: V MODE A SWEEP TIME/DIV: 0.5 ms
   TRIG MODE: AUTO A VARIABLE: CAL
2. Apply a 0.5 ms marker signal to CH1 INPUT jack. Operate the ◀▶ POSITION control to align with the first peak of the marker signal to the left end of graticule line and adjust VR9 (X74-1350) for the 11th peak to the right end of the graticule line.

A Sweep Length Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   SOURCE: V MODE A SWEEP TIME/DIV: 0.5 ms
   TRIG MODE: AUTO
2. Apply a 0.5 ms marker signal to CH1 INPUT jack.
3. Adjust VR7 (X74-1350) to display a waveform of 11.5 divisions horizontal length.

A Sweep Position Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   SOURCE: V MODE A SWEEP TIME/DIV: 0.5 ms
   TRIG MODE: AUTO
2. Apply a 0.5 ms marker signal to CH1 INPUT jack to display a waveform to the center of the CRT screen.
3. Set the FINE control to 12 o'clock position.
4. Rotate the ◀▶ POSITION control to maximum clockwise. Measure the deviation between the starting point of the trace and the center of the graticule line. Next, rotate the ◀▶ POSITION control to maximum counterclockwise and measure the distance between the 12th peak of the waveform and the center of the graticule line.
5. Adjust VR11 (X74-1350) so that these deviations will have the same width.

B Sweep Time Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: ALT Vertical MODE: CH1
   SOURCE: V MODE
   A, B SWEEP TIME/DIV: 0.5 ms
   TRIG MODE: AUTO
2. Apply a 0.5 ms marker signal to CH1 INPUT jack. On the screen A and B traces of CH1 input signal will appear. Operate the ▲▼ TRACE SEP control to bring these traces into the positions where they can be easily adjusted.
3. Operate the ◀▶ POSITION control to align with the first peak of the marker signal to the left end of the graticule line and adjust VR10 (X74-1350) for the 11th peak to the right end of the graticule line.

<Check>
Make sure that A and B TRIG'D lamps are on.

B Sweep Length Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: ALT Vertical MODE: CH1
   SOURCE: V MODE
   A, B SWEEP TIME/DIV: 0.5 ms
   A VARIABLE: Fully CCW
   TRIG MODE: AUTO SLOPE: +
   A, B INTENSITY: Fully CW
   DELAY TIME MULT: 0.20
2. Apply a 0.5 ms marker signal to CH1 INPUT jack. A and B traces will appear on the screen. Use the ▲▼ TRACE SEP control to separate them.
3. Adjust VR8 (X74-1350) to display a waveform of 11.5 divisions horizontal length.

B Sweep Position Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: ALT Vertical MODE: CH1
   SOURCE: V MODE
   A, B SWEEP TIME/DIV: 0.5 ms
   TRIG MODE: AUTO SLOPE: +
   A, B INTENSITY: Fully CW
   DELAY TIME MULT: 0.20
2. Operate ▲▼ TRACE SEP control to separate the A sweep and B sweep. Set the A VARIABLE to CAL.
3. Adjust VR12 (X74-1350) to align the starting point of B sweep with that of A sweep in the horizontal position.

X10MAG Gain Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   SOURCE: V MODE A SWEEP TIME/DIV: 0.1 ms
   TRIG MODE: AUTO
2. Apply a 0.1 ms marker signal to CH1 INPUT jack.
3. Align the first peak of the marker signal with the left end of the graticule line and the 11th peak with the right end and pull the X10MAG switch.
4. Adjust VR13 (X74-1350) so that the peak-to-peak distance is 10 divisions.

X10MAG Center Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   SOURCE: V MODE A SWEEP TIME/DIV: 0.1 ms
   A VARIABLE: CAL TRIG MODE: AUTO
   SLOPE: +
2. Apply a 0.5 ms marker signal to CH1 INPUT jack to display a waveform of 3-peaks.
3. Operate the ◀▶ POSITION control to align the center peak with the vertical center graticule line.

ADJUSTMENT

4. Adjust VR14 (X74-1350) to align the center peak of the waveform with the vertical center graticule line when the FINE control pulled out (X10MAG on).

A and B Sweep Time 50 ms adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: ALT Vertical MODE: CH1
   SOURCE: V MODE TRIG MODE: AUTO
   A VARIABLE: CAL
2. Rotate the A SWEEP TIME/DIV control to 50 ms position. Apply a 50 ms time marker signal to CH1 INPUT jack.
3. Adjust VR2 (X74-1350) to align the first peak of the marker signal with the left end of the graticule line and the 11th peak with the right end.
4. Repeat the entire procedure for B sweep time 50 ms adjustment, adjusting VR4.

A and B Sweep Time 5 μs and 0.1 μs Adjustment

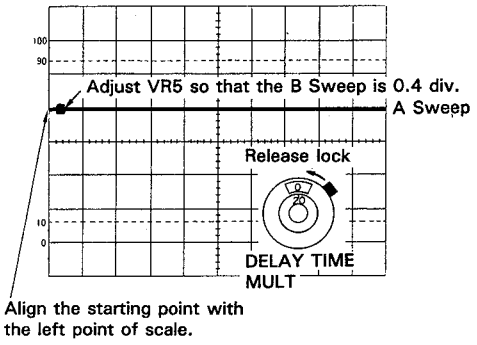
1. Set the controls and switches as follows;
   HORIZ DISPLAY: ALT Vertical MODE: CH1
   SOURCE: V MODE TRIG MODE: AUTO
   A VARIABLE: CAL
2. Rotate the A SWEEP TIME/DIV control to 5 μs position. Apply a 5 μs time marker signal to CH1 INPUT jack.
3. Adjust VR1(X74-1350) in the same procedure "Sweep Time 50 ms adjustment".
4. Next, set the A SWEEP TIME/DIV control to 0.1 μs position. Apply a 0.1 μs time marker signal to CH1 INPUT jack.
5. Adjust TC1 (X74-1350) in the procedure "Sweep Time 50 ms adjustment".
6. Repeat the entire procedure for B sweep time 5 μs and 0.1 μs sweep time adjustment, adjusting VR3 and TC2 respectively.

20ns A and B Sweep Linearity Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: ALT Vertical MODE: CH1
   SOURCE: V MODE A VARIABLE: CAL
   TRIG MODE: AUTO SLOPE: +
2. Apply a 20ns time marker signal to CH1 INPUT jack.
3. Adjust TC3 (X74-1350) so that the all peaks intervals of the marker display in the A Sweep are uniform.
4. Set the A VARIABLE to the maximum counterclockwise and adjust TC4 as the same way in step 3.
5. Set the A VARIABLE to CAL.
6. Set the ×10 MAG knob to be pulled. And adjust TC5 (for A Sweep) and TC6 (for B Sweep) so that the interval between first peak and second peak of the marker signal is 10 divisions.

DELAY TIME MULT Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: ALT Vertical MODE: CH1
   CH1 AC-GND-DC: GND TRIG MODE: AUTO
   A SWEEP TIME/DIV: 0.1 ms B SWEEP TIME/DIV: 1 μs
   ▲▼ TRACE SEP: Fully CCW
   B MODE: Pull STARTS AFTER DELAY
2. Set the DELAY TIME MULT to 0.20.
3. Operate A and B INTENSITY controls properly to make the B trace brighter and A trace light dimmer.
4. Operate the ◀▶ POSITION to bring the starting point of A trace to the left end of the graticule line. Adjust VR5 (X74-1350) so that the B trace appears as shown below.
5. Next, set the DELAY TIME MULT control to 10.00.
6. Adjust VR6 (X74-1350) so that the B trace appears as shown below.
7. Repeat step 2 through 6.


Adjust VR5 so that the B Sweep is 0.4 div.
A Sweep
Release lock
DELAY TIME MULT
Align the starting point with the left point of scale.

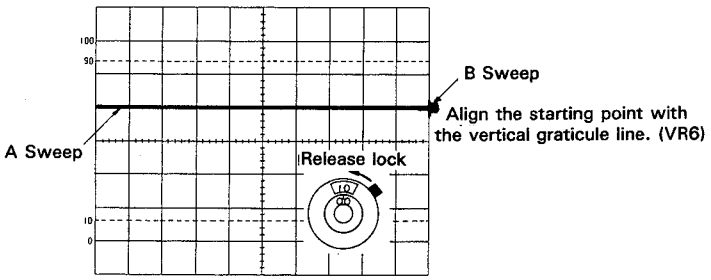


Fig. 5

X-Y OPERATION ADJUSTMENT

X Position Center Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: ALT
   CH1,CH2 VOLTS/DIV: 10 mV
   CH1,CH2 AC-GND-DC: GND SOURCE: CH1
   TRIG MODE: AUTO
   A SWEEP TIME/DIV: 0.1 ms
   Operate ▲▼ POSITION for both CH1 and CH2 to superimpose the two traces on one another in the center of the CRT screen.
2. Adjust VR15 (X74-1350) to center the center of the CRT screen when HORIZ DISPLAY is switched in X-Y position.

<Check>

Counterclockwise rotation of CH2 ▲▼ POSITION (X-Y ◀▶) controls moves the spot leftward more than 5 divisions. Clockwise rotation moves rightward more than 5 divisions.

X Gain Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: X-Y CH2 AC-GND-DC: DC
   CH2 VOLTS/DIV: 10 ms
2. Apply a 1 kHz 50 mVp-p to CH2 INPUT jack to display a waveform of 5 divisions horizontal amplitude, adjusting VR25 (X73-1500).

TRIGGERING ADJUSTMENT

Trigger Slope Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   COUPLING: AC CH1 AC-GND-DC: DC
   CH1 VOLTS/DIV: 5 mV
   A SWEEP TIME/DIV: 0.2 ms SLOPE: +
   TRIG MODE: AUTO
2. Apply a 1kHz sine wave signal to CH1 INPUT jack to display a waveform of 4 to 6 divisions vertical amplitude.
3. Operate TRIG LEVEL control and CH1 ▲▼ POSITION control to have an amplitude equally above and below the horizontal center graticule line.
4. Set the SLOPE switch to (−) position and adjust VR4 (X77-1280) to align the starting point of the waveform in the (+) SLOPE.

<Check>

Repeatedly rotate the SLOPE control from (+) to (−) and make sure that the starting points are in the same positions.

5. Repeat the entire procedure for CH2.

<Check>

Make sure that the rise slope of the waveform will be synchronized when the SLOPE switch is in the (+) position and fall slope will be synchronized when the switch is in the (−) position.

Trigger Level Center Adjustment

1. Set the controls and switches as follows;
   HORIZ DISPLAY: A Vertical MODE: CH1
   SOURCE: V MODE COUPLING: AC
   CH1 AC-GND-DC: DC
   CH1 VOLTS/DIV: 5 mV
   A SWEEP TIME/DIV: 0.2 ms SLOPE: +
   TRIG MODE: AUTO
2. Set the TRIG LEVEL control to 12 o'clock position.
3. Apply a 1 kHz sine wave signal to CH1 INPUT jack to display a waveform of 4 to 6 divisions vertical amplitude.
4. Operate CH1 ▲▼ POSITION control to have an amplitude equally above and below the horizontal center graticule line.
5. Adjust VR2 (X77-1280) to align the starting point of the waveform with the horizontal center graticule line.

<Check>

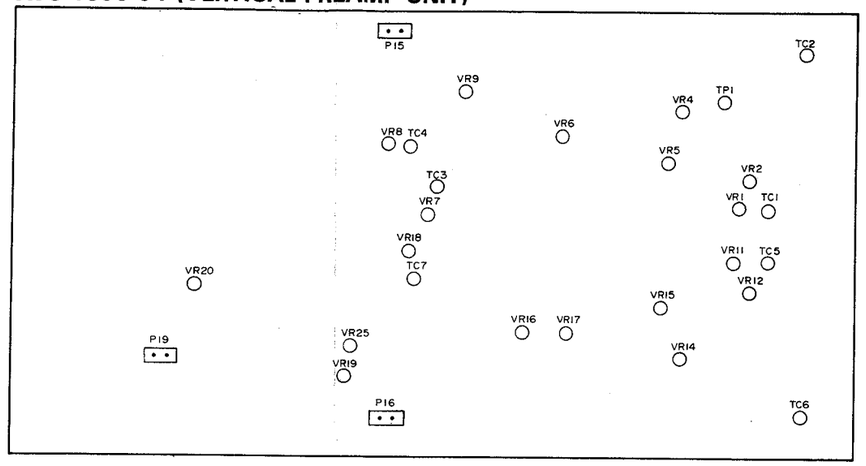
When SLOPE switch is alternately turned to (+) and (−), the starting point must be always on the horizontal center graticule line.

100 MHz Trigger Adjustment

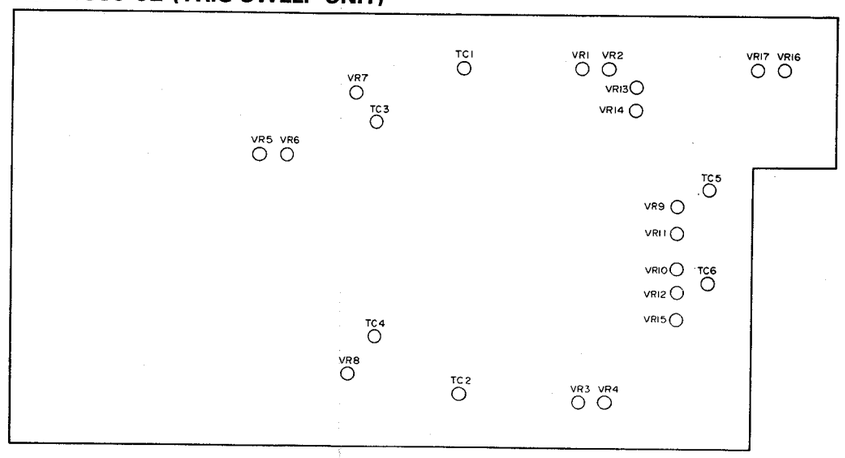
1. Set the controls and switches as follows;
   SOURCE: CH1
   A SWEEP TIME/DIV: 20 ns
2. Apply 100 MHz sine wave signal to CH1 INPUT jack to display a waveform of 0.8 division vertical amplitude.
3. Adjust TC1 (X77-1280) to synchronize at 0.8 division.

ADJUSTMENT

X73-1500-04 (VERTICAL PREAMP UNIT)



X74-1350-02 (TRIG SWEEP UNIT)



X75-1170-00 (VERTICAL ATTENUATOR UNIT)

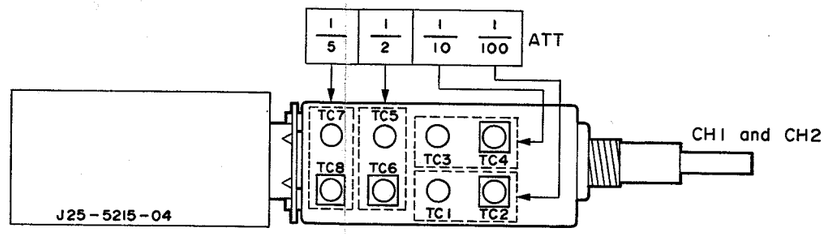


Fig. 6

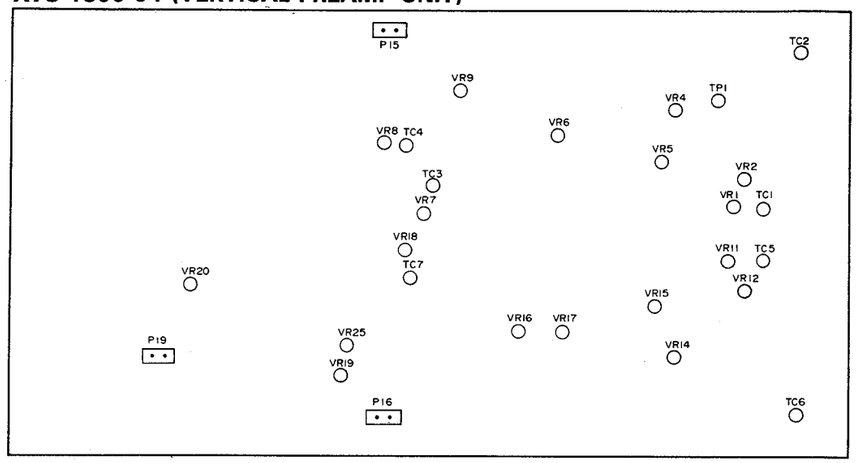
ned to (+) and (−),
ne horizontal center

ollows;

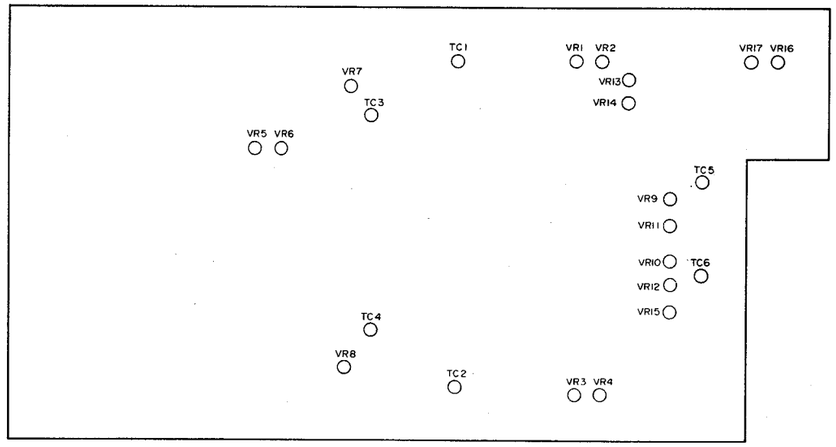
CH1 INPUT jack to
vertical amplitude.
nize at 0.8 division.

ADJUSTMENT

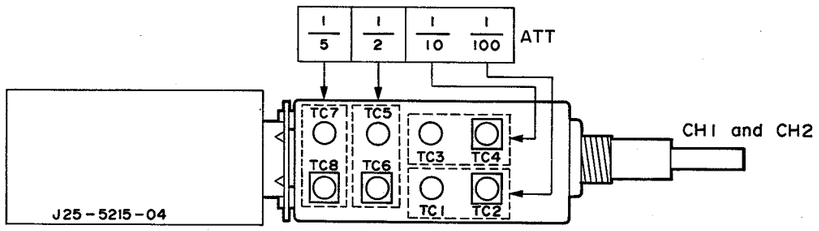
X73-1500-04 (VERTICAL PREAMP UNIT)



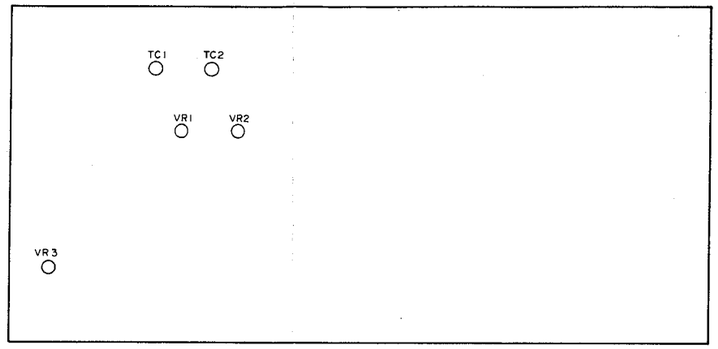
X74-1350-02 (TRIG SWEEP UNIT)



X75-1170-00 (VERTICAL ATTENUATOR UNIT)

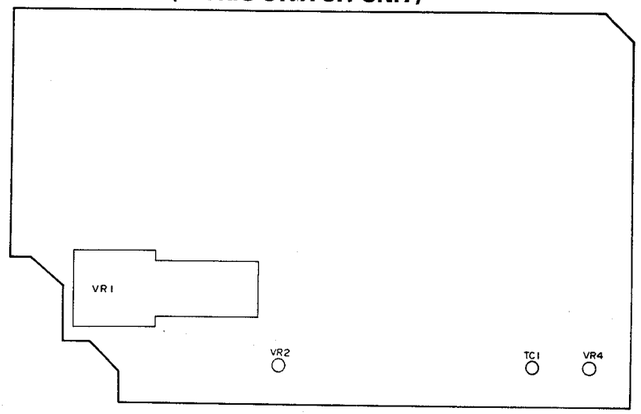


X73-1510-04 (VERTICAL OUTPUT AMP UNIT)

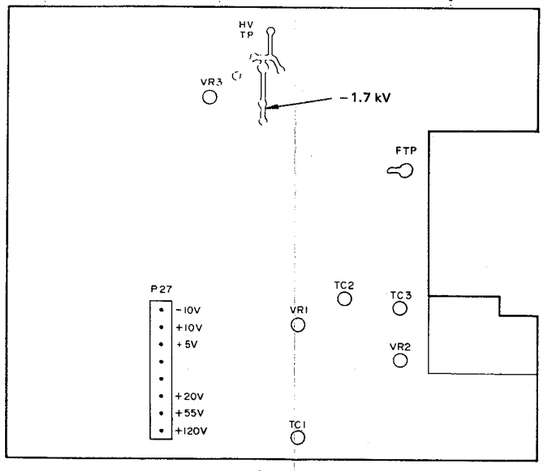


(TOP VIEW)

X77-1280-02 (A TRIG SWITCH UNIT)

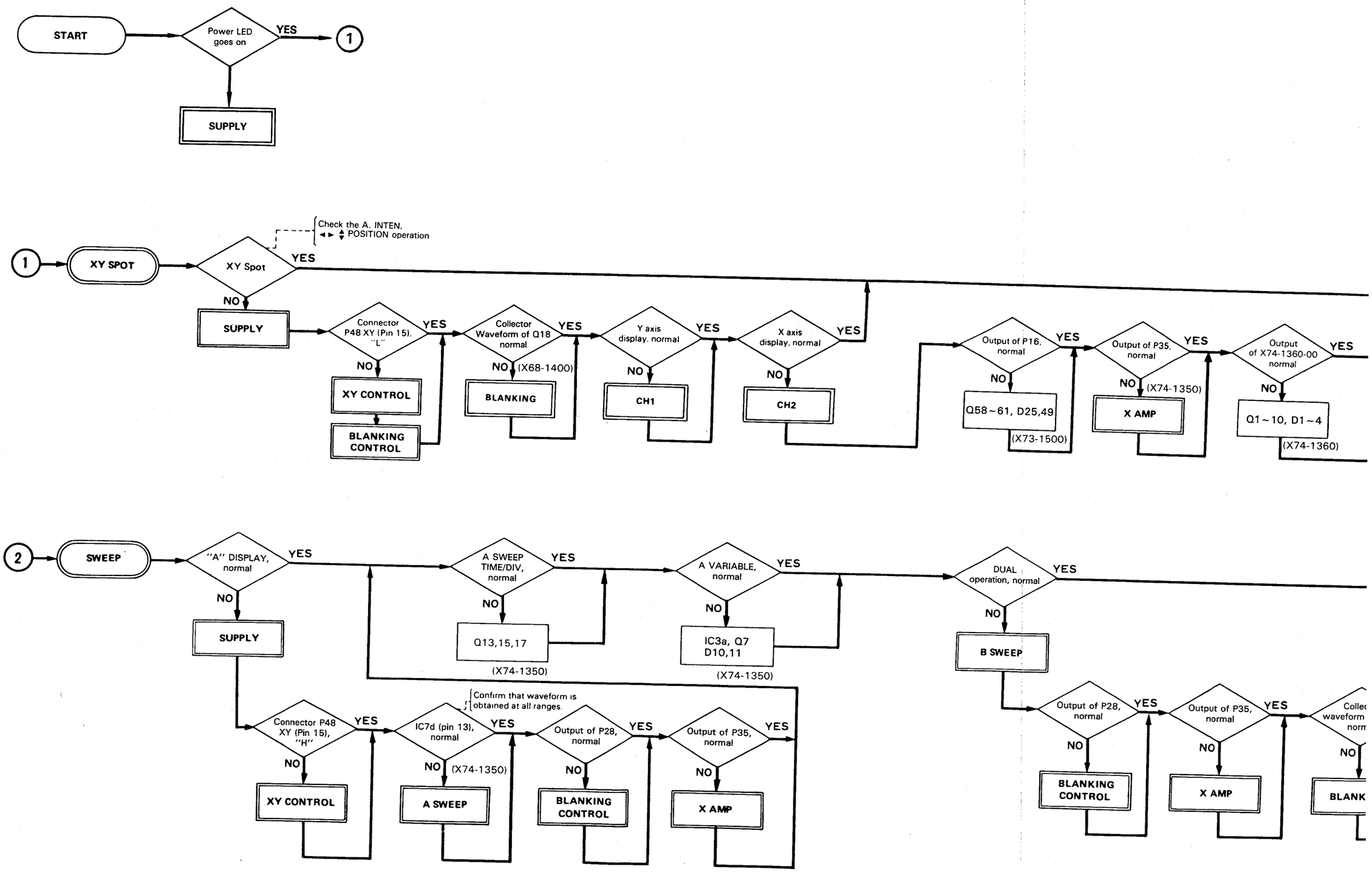


X68-1400-03 (POWER BLANKING UNIT)

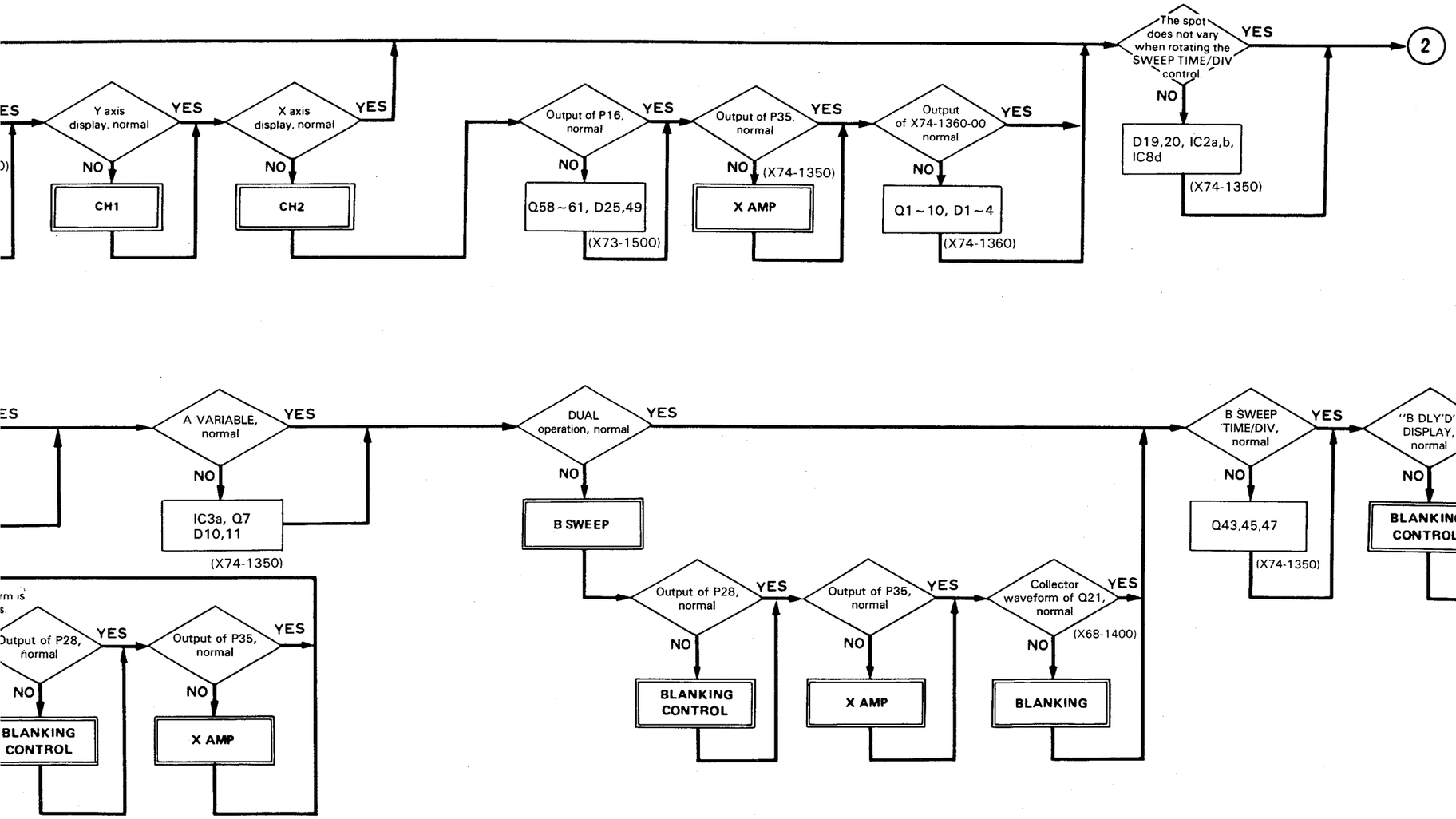


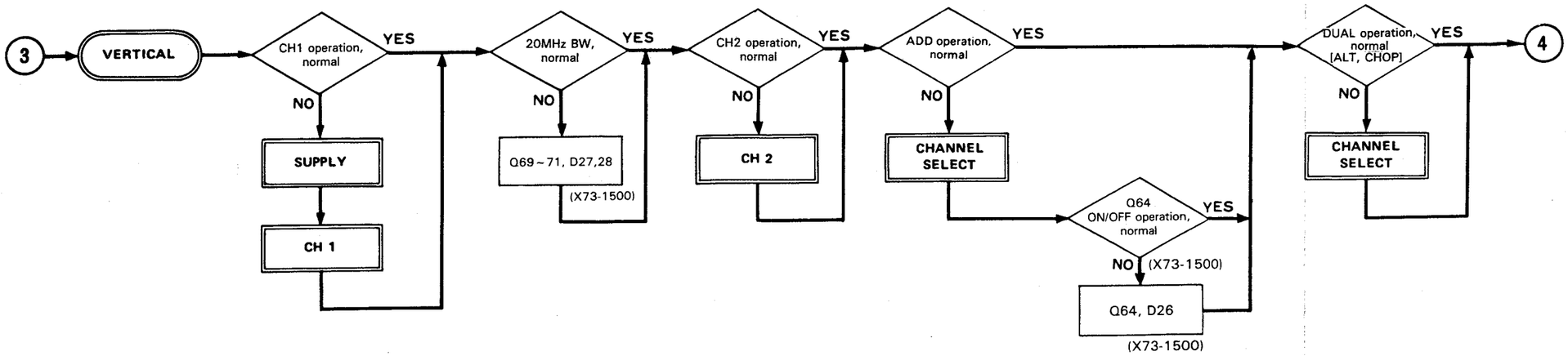
(TOP VIEW)

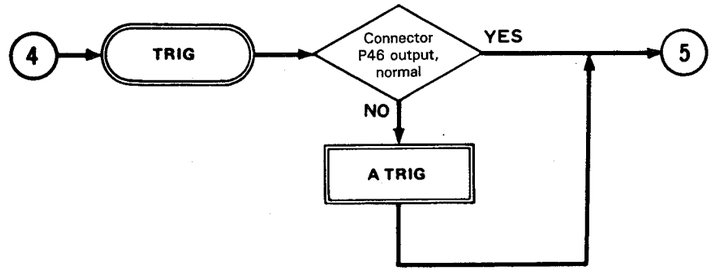
Fig. 6 LOCATION OF ADJ. CONTROLS

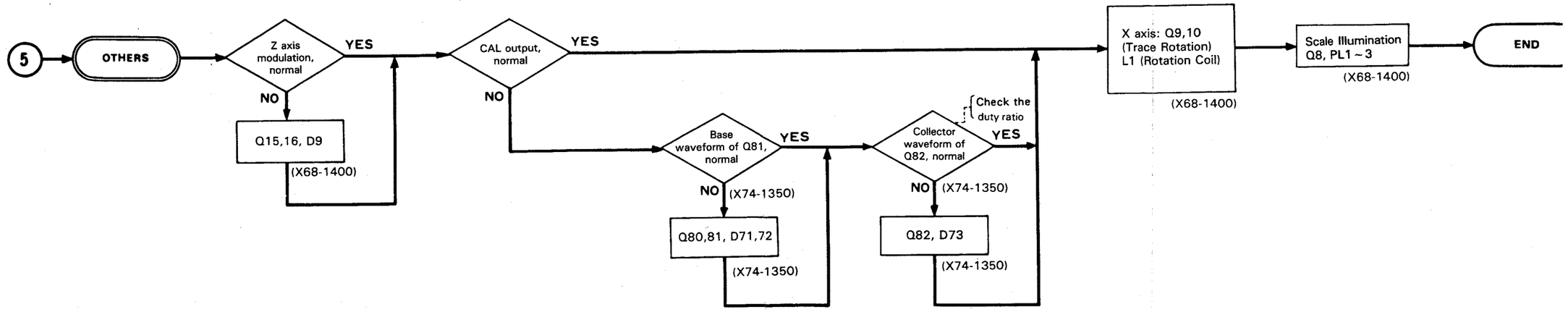

START
Power LED goes on
YES
1
SUPPLY
1
XY SPOT
XY Spot
Check the A. INTEN. ◄► ▲▼ POSITION operation
YES
NO
SUPPLY
Connector P48 XY (Pin 15), "L"
YES
NO
XY CONTROL
BLANKING CONTROL
Collector Waveform of Q18 normal
YES
NO (X68-1400)
BLANKING
Y axis display, normal
YES
NO
CH1
X axis display, normal
YES
NO
CH2
Output of P16, normal
YES
NO
Q58~61, D25,49
(X73-1500)
Output of P35, normal
YES
NO (X74-1350)
X AMP
Output of X74-1360-00 normal
YES
NO
Q1~10, D1~4
(X74-1360)
2
SWEEP
"A" DISPLAY, normal
YES
NO
SUPPLY
A SWEEP TIME/DIV, normal
YES
NO
Q13,15,17
(X74-1350)
A VARIABLE, normal
YES
NO
IC3a, Q7 D10,11
(X74-1350)
DUAL operation, normal
YES
NO
B SWEEP
Connector P48 XY (Pin 15), "H"
YES
NO
XY CONTROL
Confirm that waveform is obtained at all ranges.
IC7d (pin 13), normal
YES
NO (X74-1350)
A SWEEP
Output of P28, normal
YES
NO
BLANKING CONTROL
Output of P35, normal
YES
NO
X AMP
Output of P28, normal
YES
NO
BLANKING CONTROL
Output of P35, normal
YES
NO
X AMP

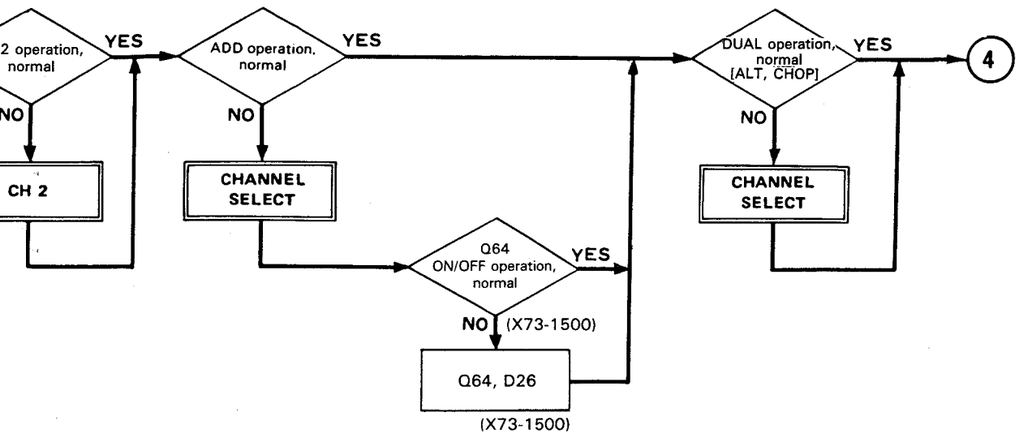
TROUBLESHOOTING

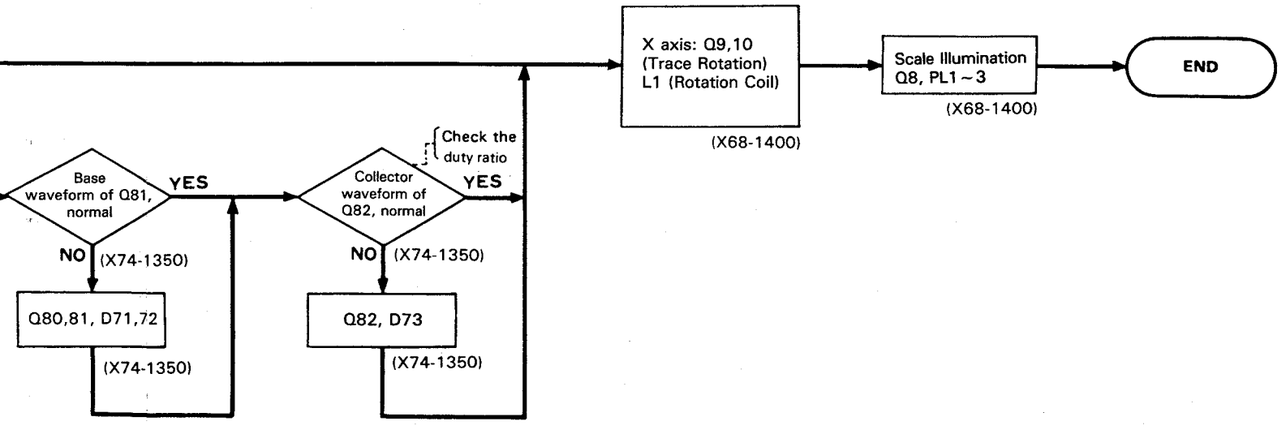



3
VERTICAL
CH1 operation, normal
YES
NO
SUPPLY
CH 1
20MHz BW, normal
YES
NO
Q69~71, D27,28
(X73-1500)
CH2 operation, normal
YES
NO
CH 2
ADD operation, normal
YES
NO
CHANNEL SELECT
Q64 ON/OFF operation, normal
YES
NO (X73-1500)
Q64, D26
(X73-1500)
DUAL operation, normal [ALT, CHOP]
YES
NO
CHANNEL SELECT
4


4
TRIG
Connector P46 output, normal
YES
NO
A TRIG
5


5
OTHERS
Z axis modulation, normal
YES
NO
Q15,16, D9
(X68-1400)
CAL output, normal
YES
NO
Base waveform of Q81, normal
YES
NO (X74-1350)
Q80,81, D71,72
(X74-1350)
Collector waveform of Q82, normal
YES
NO (X74-1350)
Check the duty ratio
Q82, D73
(X74-1350)
X axis: Q9,10 (Trace Rotation) L1 (Rotation Coil)
(X68-1400)
Scale Illumination Q8, PL1~3
(X68-1400)
END





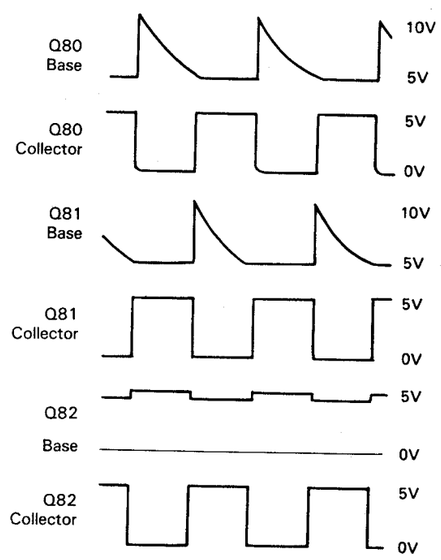
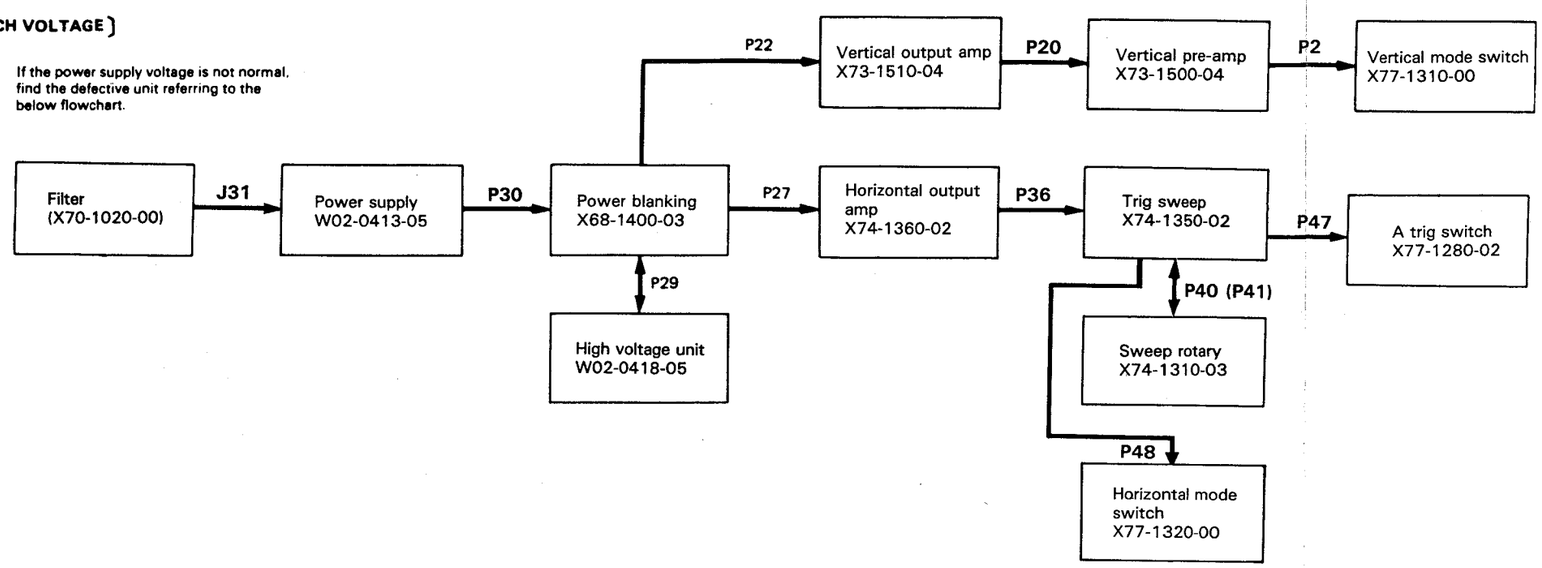
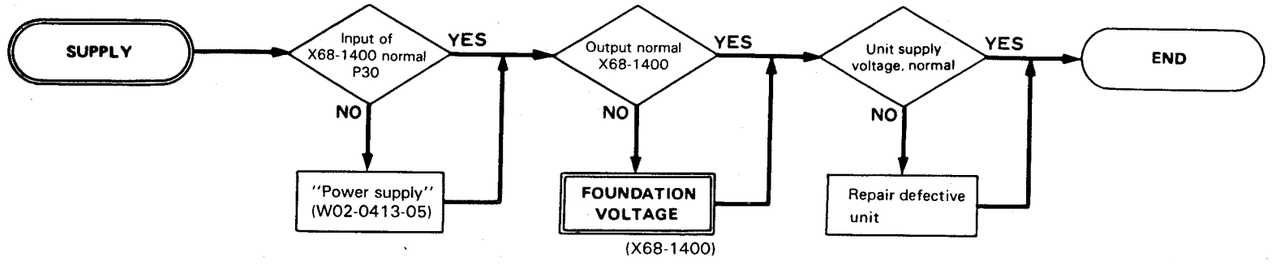


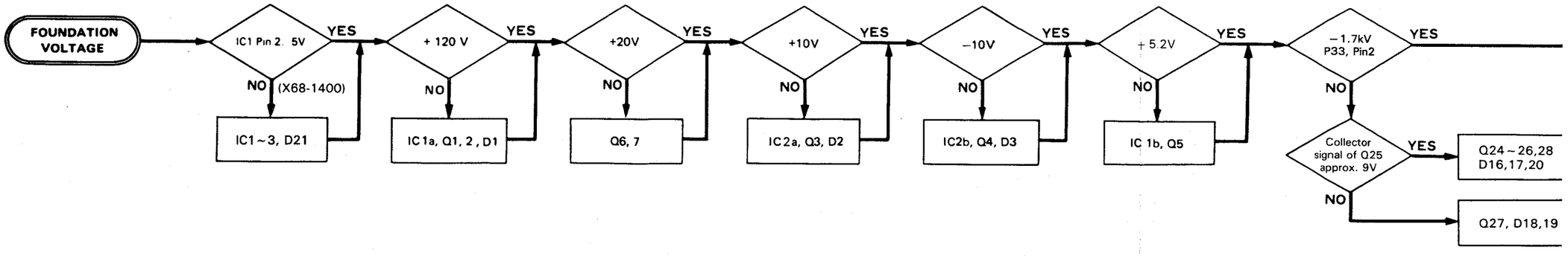
Fig. 7 CAL CIRCUIT WAVEFORMS

[POWER SUPPLY OF EACH VOLTAGE]

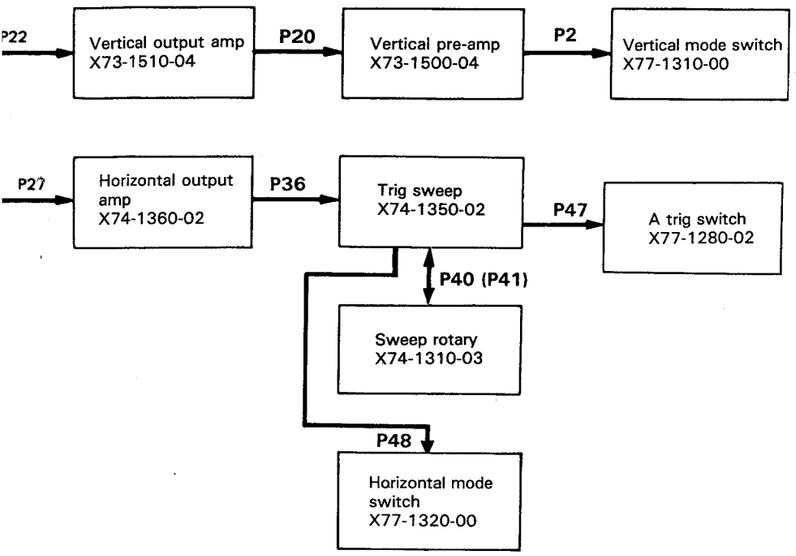
If the power supply voltage is not normal, find the defective unit referring to the below flowchart.

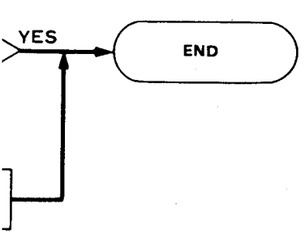


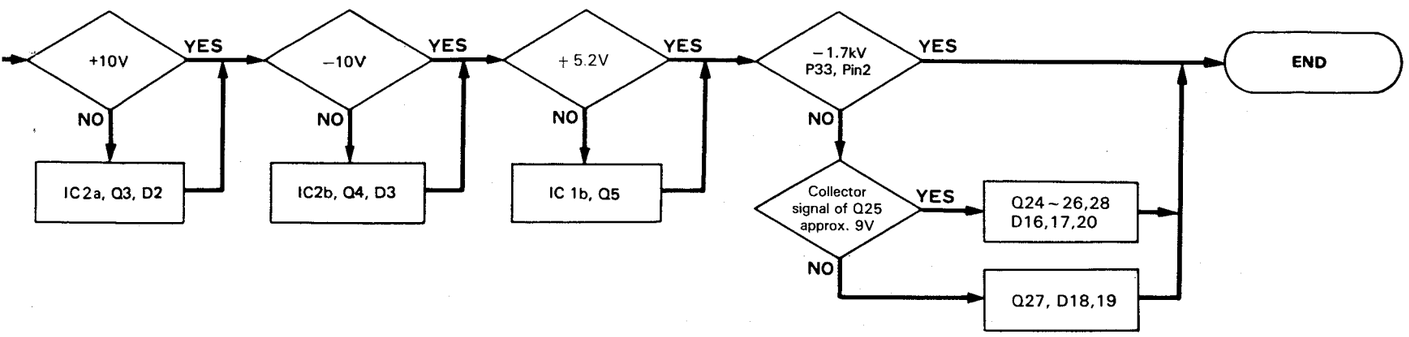


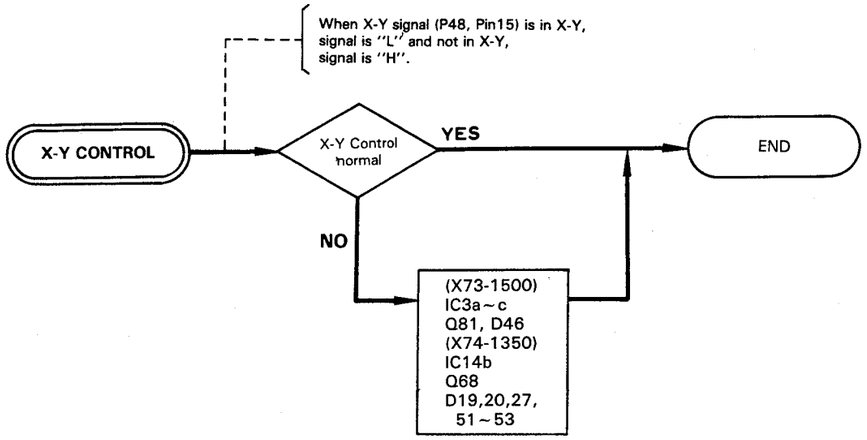


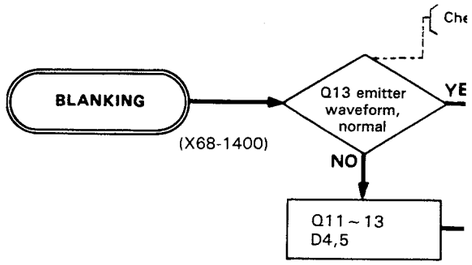
TROUBLESHOOTING

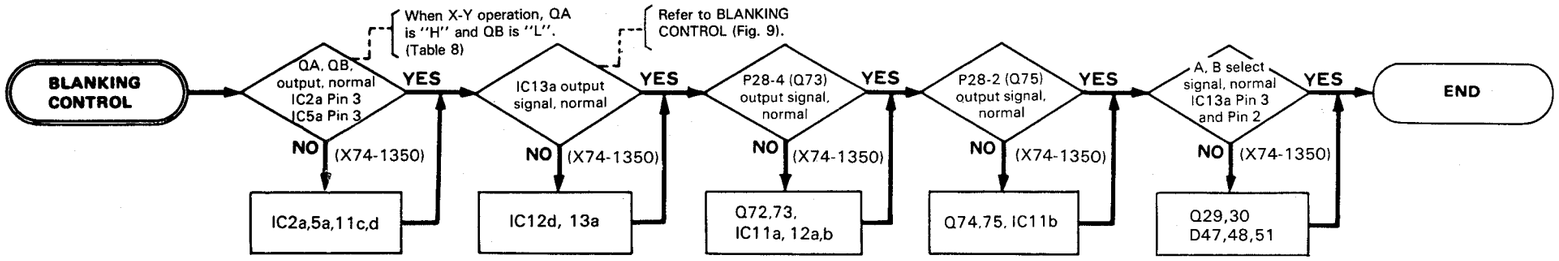


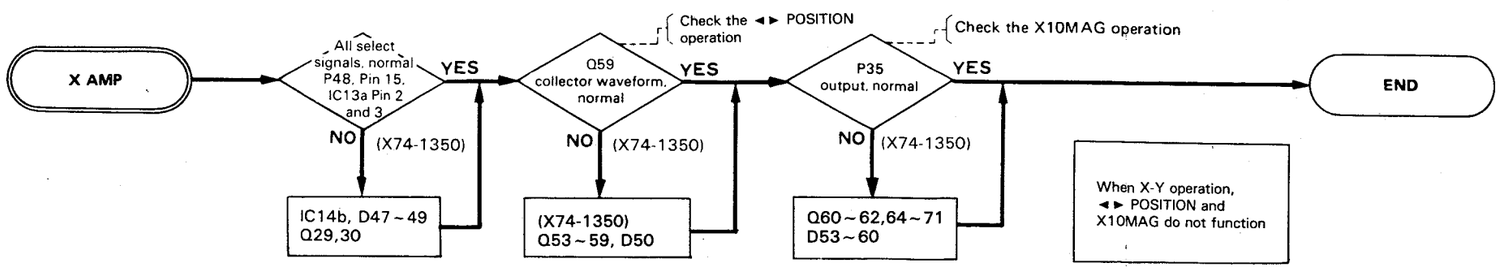












BLANKING CONTROL

HORIZ DISPLAY	P48 X-Y BUFFER 15Pin	IC13a IN S	IC13a IN R	IC13a OUT Q	IC13a OUT $\overline{Q}$	IC12d OUT	bla
A	H	H	L	H	L	H	
ALT	H	L	L	TOGGLE		H	
B-DLY'D	H	L	H	L	H	H	
X-Y	L	H	L	H	L	H	

Complex waveform IC11b output. When CHOP operatio
output of P28 is complex CHOP signal waveform.

Table-8

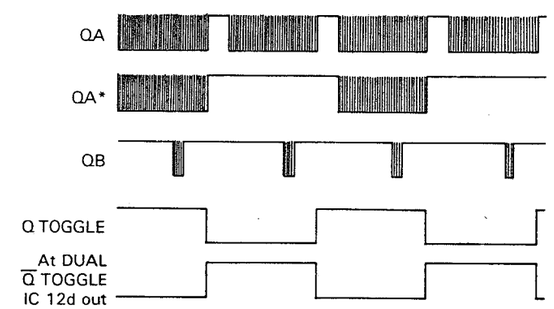
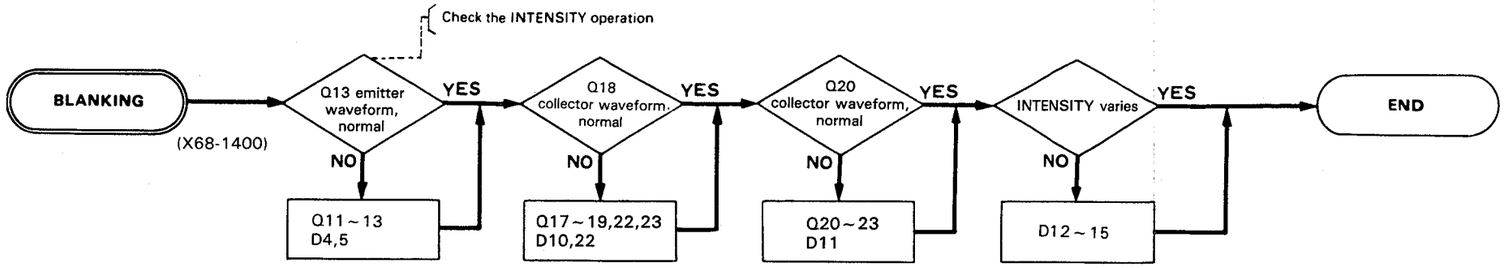


Fig. 8 RELATIONSHIP BETWEEN A, B SWEEP AND

TROUBLESHOOTING

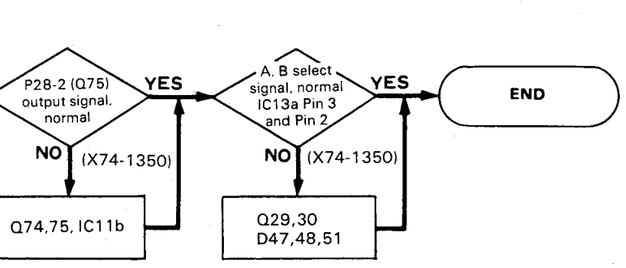


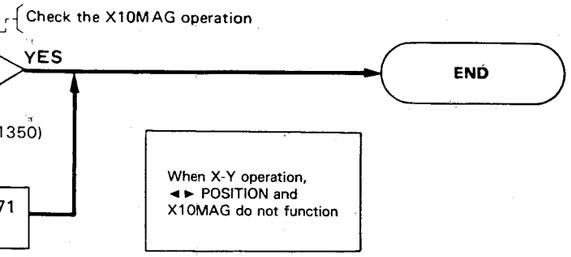
BLANKING CONTROL

HORIZ DISPLAY	P48 X-Y BUFFER 15Pin	IC13a IN S	IC13a IN R	IC13a OUT Q	IC13a OUT $\overline{Q}$	IC12d OUT	P28 A. blanking 4 Pin	P28 B. blanking 2 Pin
A	H	H	L	H	L	H	QA	H
ALT	H	L	L	TOGGLE		H	QA*	QB
B-DLY'D	H	L	H	L	H	H	H	QB
X-Y	L	H	L	H	L	H	L	H

Complex waveform IC11b output. When CHOP operation, output of P28 is complex CHOP signal waveform.

Table-8





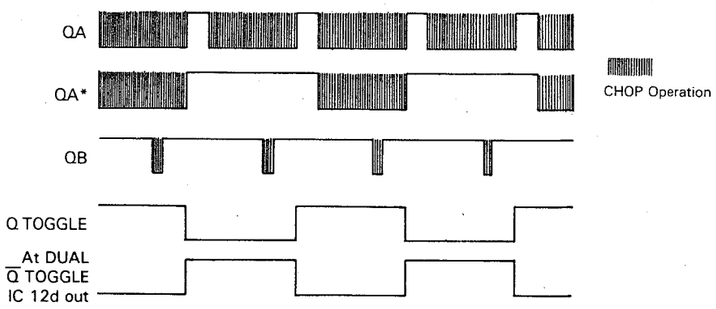


Fig. 8 RELATIONSHIP BETWEEN A, B SWEEP AND QA, QB

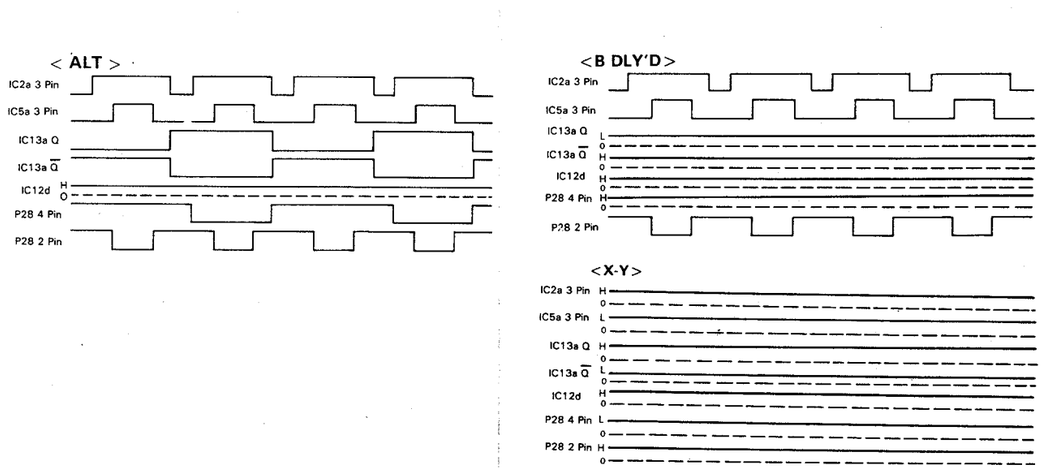
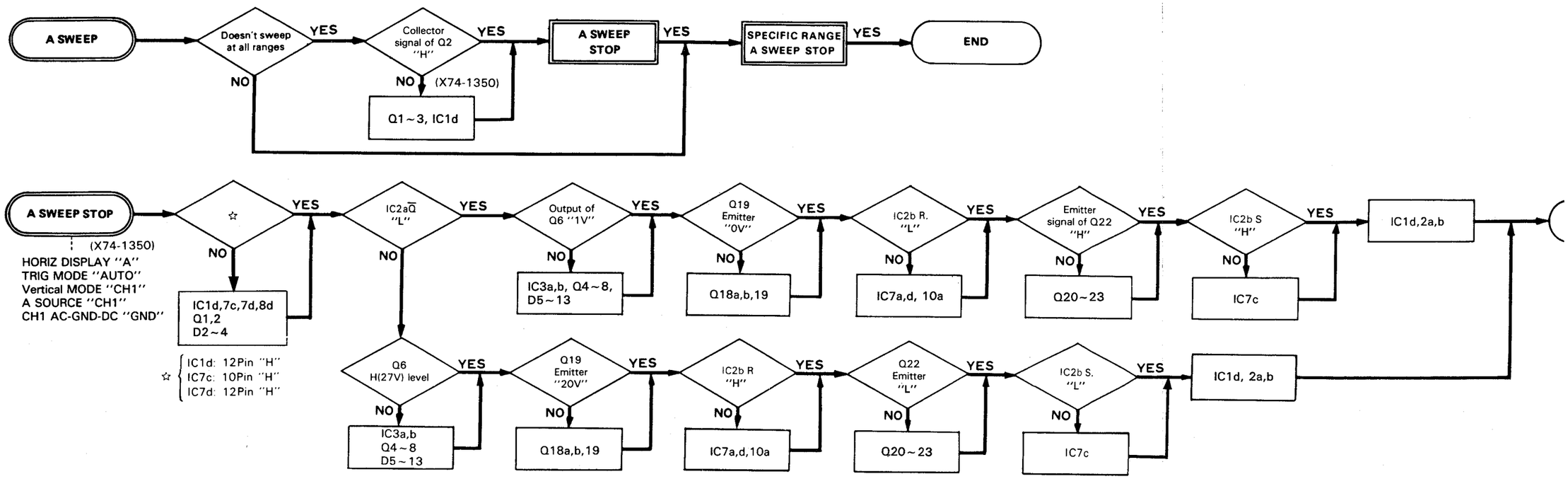
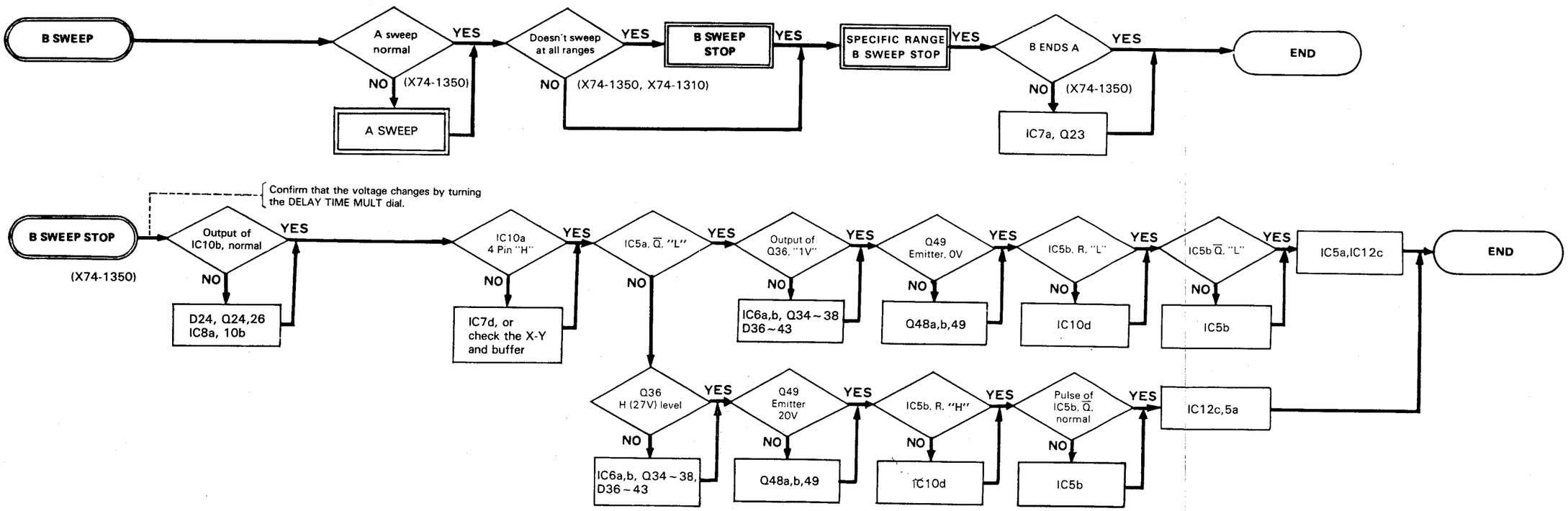
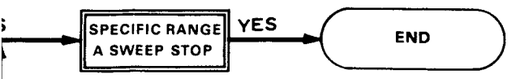


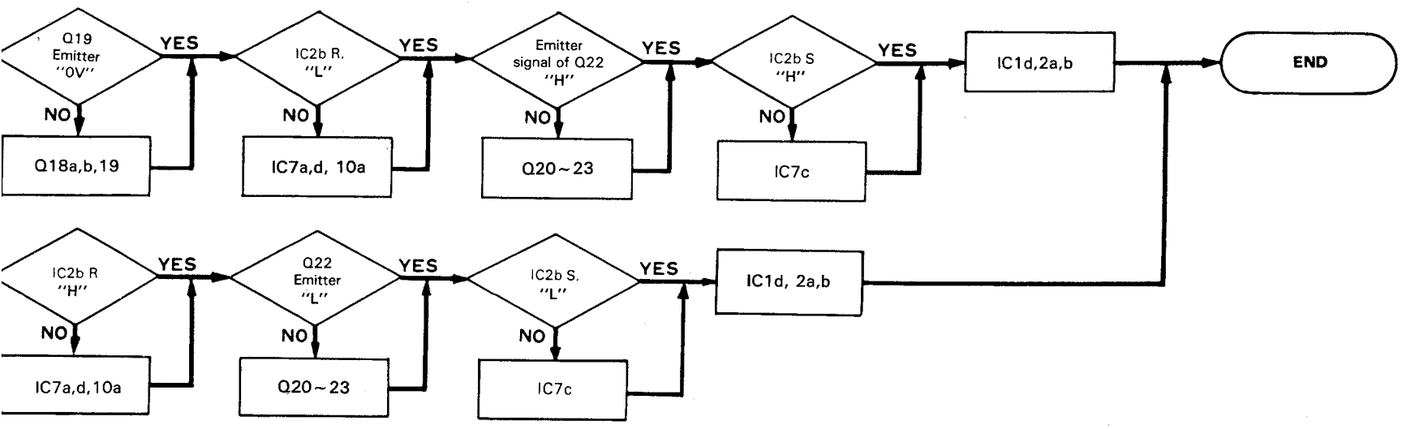
Fig. 9 BLANKING CONTROL

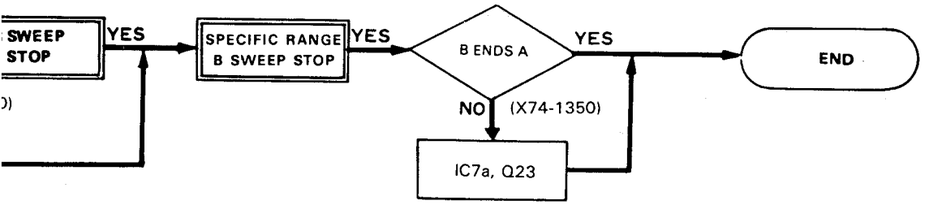

A SWEEP
Doesn't sweep at all ranges
YES
NO
Collector signal of Q2 "H"
YES
NO (X74-1350)
Q1~3, IC1d
A SWEEP STOP
YES
SPECIFIC RANGE A SWEEP STOP
YES
END
A SWEEP STOP
(X74-1350)
HORIZ DISPLAY "A"
TRIG MODE "AUTO"
Vertical MODE "CH1"
A SOURCE "CH1"
CH1 AC-GND-DC "GND"
☆
IC1d,7c,7d,8d Q1,2 D2~4
☆ IC1d: 12Pin "H"
IC7c: 10Pin "H"
IC7d: 12Pin "H"
IC2a$\overline{Q}$ "L"
Output of Q6 "1V"
IC3a,b, Q4~8, D5~13
Q19 Emitter "0V"
Q18a,b,19
IC2b R. "L"
IC7a,d, 10a
Emitter signal of Q22 "H"
Q20~23
IC2b S "H"
IC7c
IC1d,2a,b
Q6 H(27V) level
IC3a,b Q4~8 D5~13
Q19 Emitter "20V"
Q18a,b,19
IC2b R "H"
IC7a,d,10a
Q22 Emitter "L"
Q20~23
IC2b S. "L"
IC7c
IC1d, 2a,b

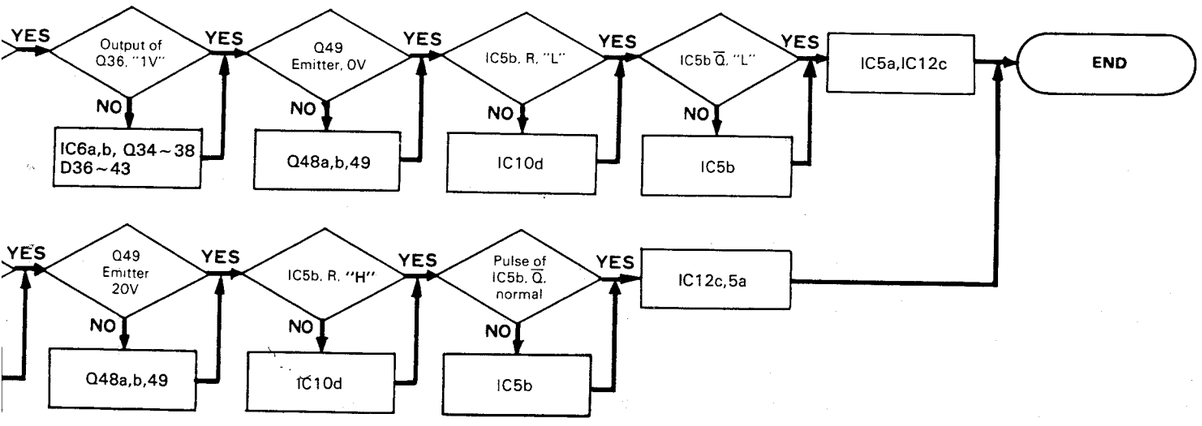

B SWEEP
A sweep normal
YES
NO (X74-1350)
A SWEEP
Doesn't sweep at all ranges
YES
NO (X74-1350, X74-1310)
B SWEEP STOP
YES
SPECIFIC RANGE B SWEEP STOP
YES
B ENDS A
YES
NO (X74-1350)
IC7a, Q23
END
B SWEEP STOP
(X74-1350)
Confirm that the voltage changes by turning the DELAY TIME MULT dial.
Output of IC10b, normal
YES
NO
D24, Q24,26 IC8a, 10b
IC10a 4 Pin "H"
YES
NO
IC7d, or check the X-Y and buffer
IC5a, $\overline{Q}$. "L"
YES
NO
Output of Q36, "1V"
YES
NO
IC6a,b, Q34~38 D36~43
Q49 Emitter, 0V
YES
NO
Q48a,b,49
IC5b. R. "L"
YES
NO
IC10d
IC5b $\overline{Q}$. "L"
YES
NO
IC5b
IC5a,IC12c
Q36 H (27V) level
YES
NO
IC6a,b, Q34~38, D36~43
Q49 Emitter 20V
YES
NO
Q48a,b,49
IC5b. R. "H"
YES
NO
IC10d
Pulse of IC5b. $\overline{Q}$. normal
YES
NO
IC5b
IC12c,5a

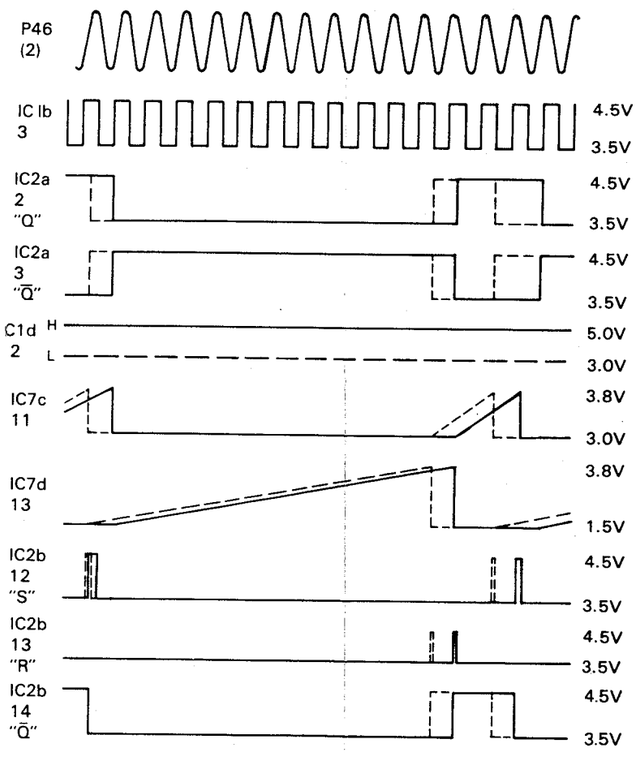
TROUBLESHOOTING





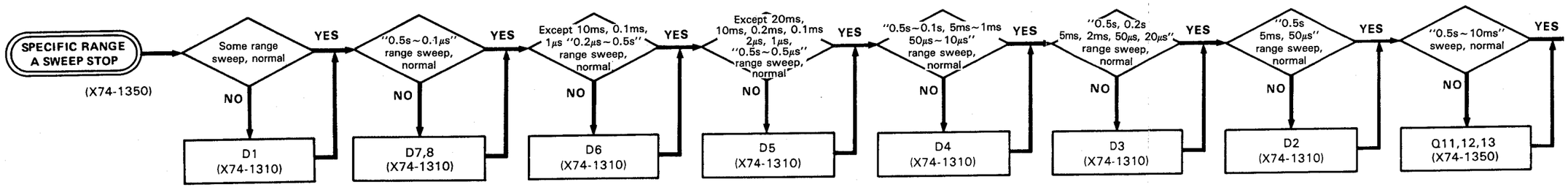


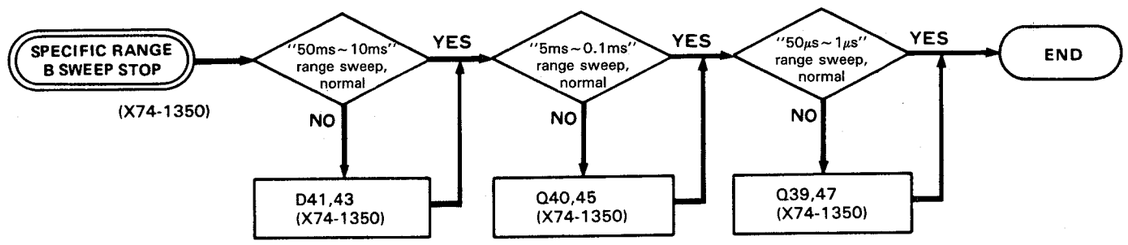




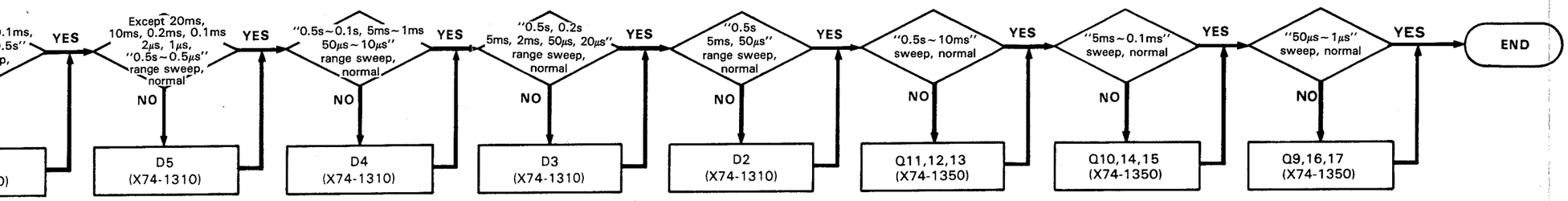
Note: Broke-line auto free run (at non-signal)

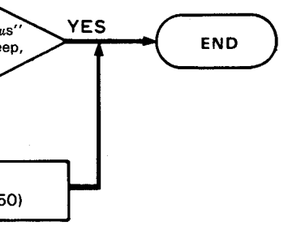
Fig. 10 Waveform in Sweep circuit (X74-1350-02) (Input signal 1 kHz, SWEEP TIME 1 ms/div)

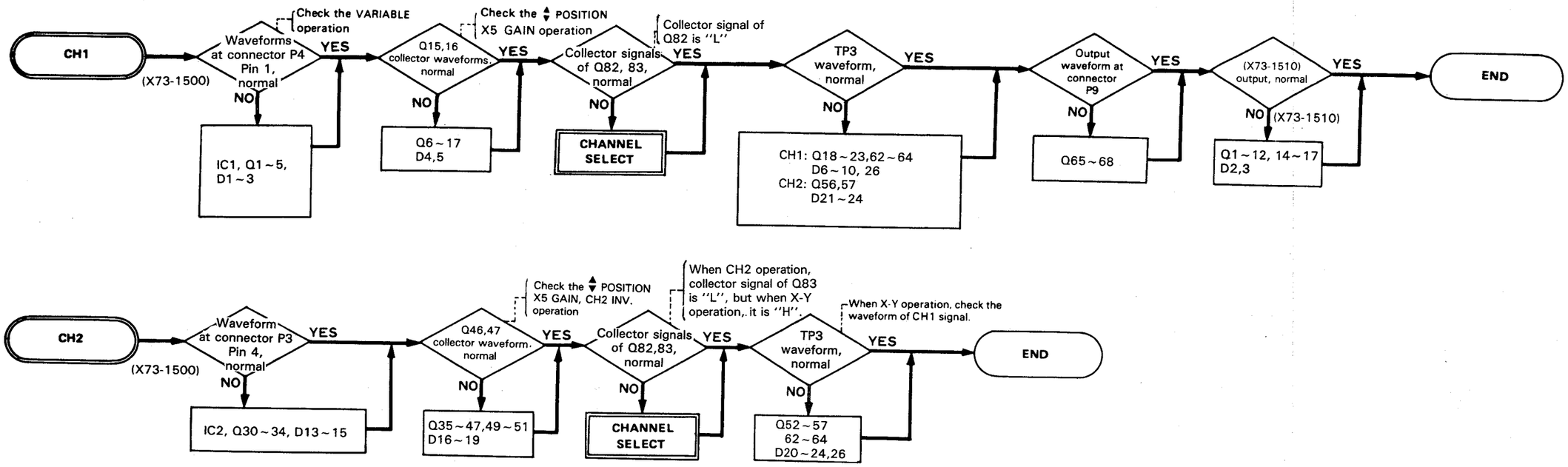

SPECIFIC RANGE A SWEEP STOP
(X74-1350)
Some range sweep, normal
YES
NO
D1 (X74-1310)
"0.5s~0.1μs" range sweep, normal
YES
NO
D7,8 (X74-1310)
Except 10ms, 0.1ms, 1μs "0.2μs~0.5s" range sweep, normal
YES
NO
D6 (X74-1310)
Except 20ms, 10ms, 0.2ms, 0.1ms 2μs, 1μs, "0.5s~0.5μs" range sweep, normal
YES
NO
D5 (X74-1310)
"0.5s~0.1s, 5ms~1ms 50μs~10μs" range sweep, normal
YES
NO
D4 (X74-1310)
"0.5s, 0.2s 5ms, 2ms, 50μs, 20μs" range sweep, normal
YES
NO
D3 (X74-1310)
"0.5s 5ms, 50μs" range sweep, normal
YES
NO
D2 (X74-1310)
"0.5s~10ms" sweep, normal
YES
NO
Q11,12,13 (X74-1350)


SPECIFIC RANGE B SWEEP STOP
(X74-1350)
"50ms~10ms" range sweep, normal
YES
NO
D41,43 (X74-1350)
"5ms~0.1ms" range sweep, normal
YES
NO
Q40,45 (X74-1350)
"50μs~1μs" range sweep, normal
YES
NO
Q39,47 (X74-1350)
END

TROUBLESHOOTING

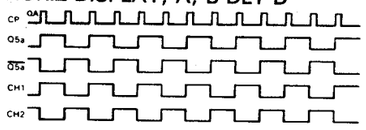




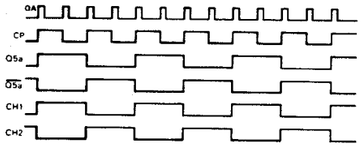


① Vertical MODE; ALT

HORIZ DISPLAY; A, B DLY'D

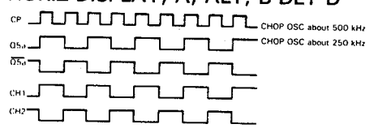


HORIZ DISPLAY; ALT



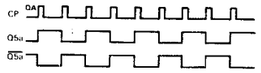
② Vertical MODE; CHOP

HORIZ DISPLAY; A, ALT, B DLY'D



③ Vertical MODE; ADD

HORIZ DISPLAY; A, B DLY'D



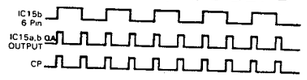
HORIZ DISPLAY; ALT

Q5a "H" or "L"

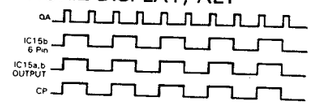
Q5a "L" or "H"

④ Vertical MODE; ALT, CHOP

HORIZ DISPLAY; A, B DLY'D

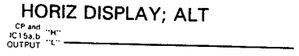


HORIZ DISPLAY; ALT

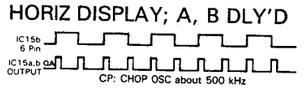


Vertical MODE; CH1, CH2, ADD

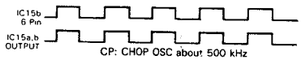
HORIZ DISPLAY; ALT



HORIZ DISPLAY; A, B DLY'D



HORIZ DISPLAY; ALT



⑤ HORIZ DISPLAY; ALT

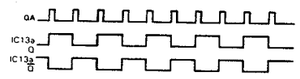
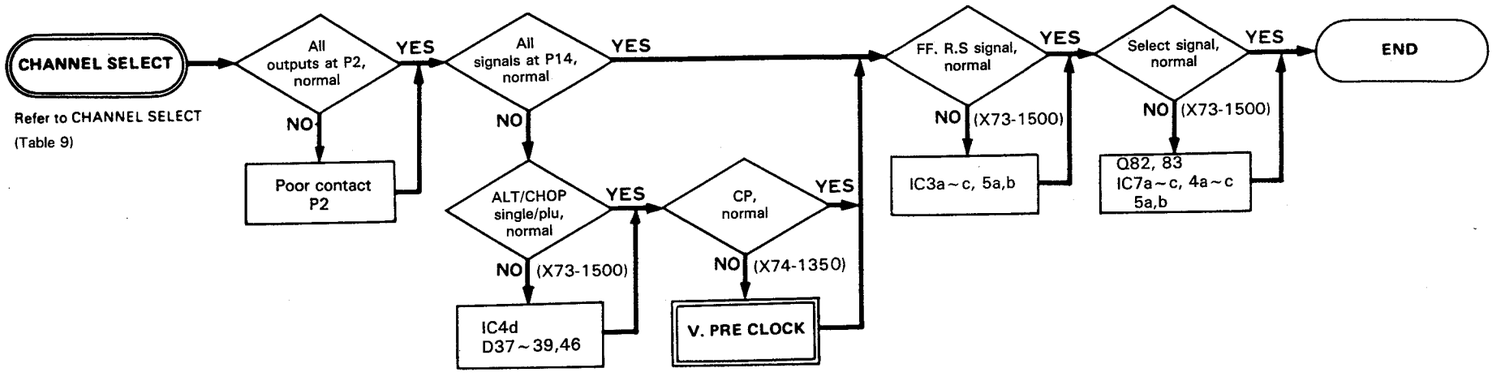
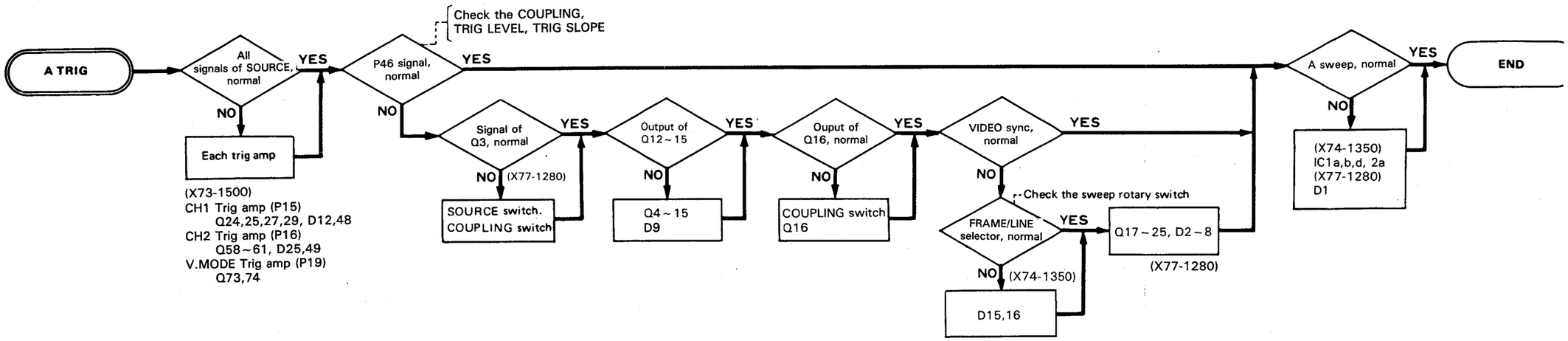
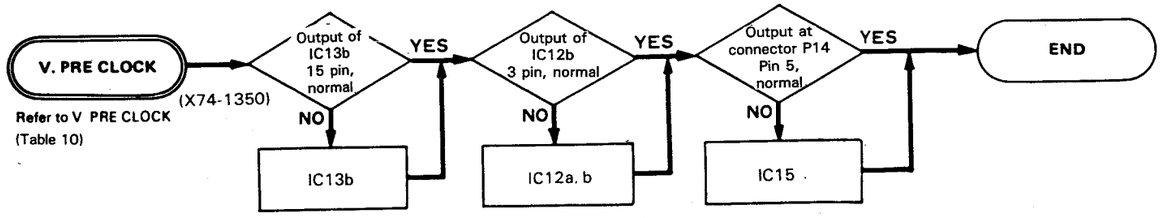


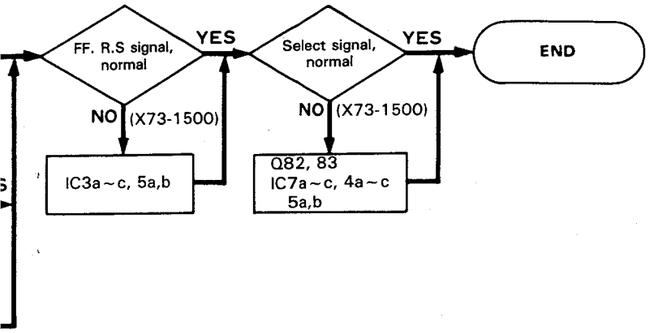
Fig. 11 Time Chart

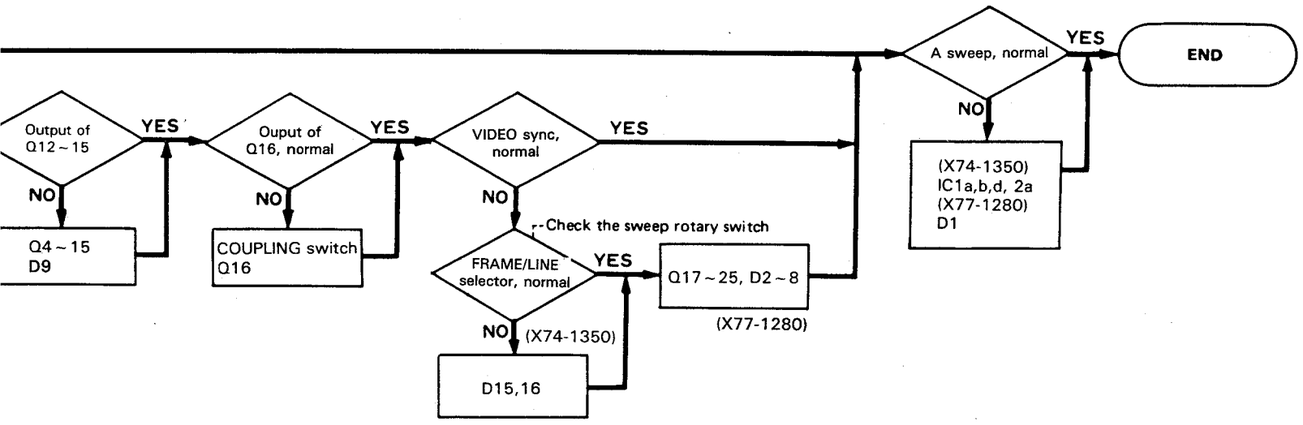

CHANNEL SELECT
Refer to CHANNEL SELECT (Table 9)
All outputs at P2, normal
YES
NO
Poor contact P2
All signals at P14, normal
YES
NO
ALT/CHOP single/plu, normal
YES
NO (X73-1500)
IC4d D37~39,46
CP, normal
YES
NO (X74-1350)
V. PRE CLOCK
FF. R.S signal, normal
YES
NO (X73-1500)
IC3a~c, 5a,b
Select signal, normal
YES
NO (X73-1500)
Q82, 83 IC7a~c, 4a~c 5a,b
END

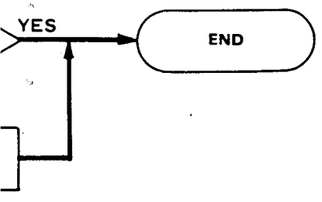

A TRIG
All signals of SOURCE, normal
YES
NO
Each trig amp
(X73-1500)
CH1 Trig amp (P15)
Q24,25,27,29, D12,48
CH2 Trig amp (P16)
Q58~61, D25,49
V.MODE Trig amp (P19)
Q73,74
Check the COUPLING, TRIG LEVEL, TRIG SLOPE
P46 signal, normal
YES
NO
Signal of Q3, normal
YES
NO (X77-1280)
SOURCE switch. COUPLING switch
Output of Q12~15
YES
NO
Q4~15 D9
Ouput of Q16, normal
YES
NO
COUPLING switch Q16
VIDEO sync, normal
YES
NO
Check the sweep rotary switch
FRAME/LINE selector, normal
YES
NO (X74-1350)
D15,16
Q17~25, D2~8
(X77-1280)
A sweep, normal
YES
NO
(X74-1350)
IC1a,b,d, 2a
(X77-1280)
D1
END


V. PRE CLOCK
(X74-1350)
Refer to V PRE CLOCK (Table 10)
Output of IC13b 15 pin, normal
YES
NO
IC13b
Output of IC12b 3 pin, normal
YES
NO
IC12a. b
Output at connector P14 Pin 5, normal
YES
NO
IC15
END

TROUBLESHOOTING







CHANNEL SELECT

			MODE INPUT LOG OUTPUT signal (P2)						FLIP-FLOP PRESET CLEAR signal			CHANNEL SELECT signal		FLIP-FLOP OUTPUT signal				VERTICAL CLOCK (P14)		
			CH1	CH2	DUAL	ADD	ALT	X-Y	R5a	S5a	R5b	CH1	CH2	Q5a	Q5a	Q5b	Q5b	ALT/CHOP	Single/Plu	CP*1
SWEEP operation	CH1		L	H	H	H	H	H	H	L	H	L	H	L	H	L	H	L	L	QA
	CH2		H	L	H	H	H	H	L	H	H	H	L	H	L	L	H	L	L	QA
	DUAL	ALT	H	H	L	H	L	H	L	L	H	(1)		(1)		L	H	L	H	QA
		CHOP					H					(2)		(2)				H		2
	ADD		H	H	H	L	H	H	L	L	H	L	L	(3)		L	H	L	L	QA
X-Y operation			Same as above					L	H	H	H	L	H			L	H	L	L	L

Note; Number of ◯ is No. of time chart. (See Fig. 11)

*1 HORIZ DISPLAY; ALT
Time chart No. ④.

Table-9

V. PRE CLOCK

		INPUT		OUTPUT		
	MODE	ALT/CHOP	Single/Plu	Q76	IC15a,b	CP*2
SWEEP operation	CH1	L	L	H	QA	QA
	CH2	L	L	H		QA
	DUAL ALT	L	H	H		QA
	DUAL CHOP	H		L		2
	ADD	L	L	H		QA
X-Y operation		L	L	H	L	L

Note; Nomber of ◯ is No. of time chart.

*2 HORIZ DISPLAY; ALT
Time chart No. 4.

V. PRE CLOCK

HORIZ DISPLAY	IC15b 7 Pin	IC15b 6 Pin*3	IC15a,b*3 OUTPUT	IC13a Q
A	L	L	QA	H
ALT	H	L	L	(5),*4
B DLY'D	L	L	QA	H
X-Y	H	L	L	H

*3 Vertical MODE; DUAL
Time chart No. 4,.

*4 Vertical MODE; DUAL
Time chart No. 1, 2,.

Table-10

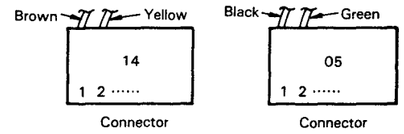
PARTS LIST

The specifications and parts list and schematic diagram may be changed without notice owing to a technical innovation.

The part No. of each connector is stamped or color-coded. The color-coding is as follows.

Black	Brown	Red	Orange	Yellow	Green	Blue	Purple	Grey	White
0	1	2	3	4	5	6	7	8	9

Example



Each connector can be classified by the color of pin 1 and pin 2.

PARTS LIST

POWER BLANKING UNIT

X68-1400-03

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E29-0504-05	TEFLON TERMINAL			
	F02-0503-24	HEAT SINK			
	F09-0506-05	PROTECTION COVER (CAPACITOR)			
	F15-0727-04	HOLDER (NEON LAMP)			
	F20-0516-05	INSULATOR			
	F20-0623-05	INSULATOR			
	J25-5038-72	PCB (UNMOUNTED)			
	N09-0167-05	SCREW, POLYCARBONATE			
	R92-1061-05	JUMPING RES.	ZERO OHM		
	212-1018-05	TUBE (PLASTIC)			
	212-3017-05	TUBE (PLASTIC)			
C001	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C002	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C003	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C004	CE04EW1J330M	CAP. ELECTRO	33	20%	63V
C005	CE04W2C3R3M	CAP. ELECTRO	3.3	20%	160V
C006	CE04W2C3R3M	CAP. ELECTRO	3.3	20%	160V
C007	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C008	C91-0549-05	CAP. TANTALUM	1	20%	35V
C009	CE04EW1E101M	CAP. ELECTRO	100	20%	25V
C010	CE04EW1E101M	CAP. ELECTRO	100	20%	25V
C011	CE04EW1A221M	CAP. ELECTRO	220	20%	10V
C012	CE04EW1V100M	CAP. ELECTRO	10	20%	35V
C013	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C014	CE04EW1V470M	CAP. ELECTRO	47	20%	35V
C015	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C016	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C017	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C018	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C019	CC45SL1H681J	CAP. CERAMIC	680P	5%	50V
C020	CC45SL1H681J	CAP. CERAMIC	680P	5%	50V
C023	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C024	CC45CH2H0R5C	CAP. CERAMIC	0.5P	0.25P	500V
C025	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C026	C91-0549-05	CAP. TANTALUM	1	20%	35V
C027	CC45CH2H030C	CAP. CERAMIC	3P	0.25P	500V
C028	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C029	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C030	CE04W2C3R3M	CAP. ELECTRO	3.3	20%	160V
C031	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C032	CE04EW1A221M	CAP. ELECTRO	220	20%	10V
C033	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C034	CE04EW1E101M	CAP. ELECTRO	100	20%	25V
C035	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C036	C91-0571-05	CAP. CERAMIC	0.01		2KV
C037	C91-0571-05	CAP. CERAMIC	0.01		2KV
C038	C91-0571-05	CAP. CERAMIC	0.01		2KV
C039	C91-0571-05	CAP. CERAMIC	0.01		2KV
C040	CK45E3F102P	CAP. CERAMIC	1000P		3.1K
C041	CQ93M1H154K	CAP. MYLAR	0.15	10%	50V
C042	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C043	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C044	CE04EW1E470M	CAP. ELECTRO	47	20%	25V
C045	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C046	CE04EW1E470M	CAP. ELECTRO	47	20%	25V
C047	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C048	CE04EW1E470M	CAP. ELECTRO	47	20%	25V
C049	CQ93M1H472K	CAP. MYLAR	4700P	10%	50V
C050	CE04EW1E470M	CAP. ELECTRO	47	20%	25V
C051	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C052	C91-0571-05	CAP. CERAMIC	0.01		2KV
C053	C91-0571-05	CAP. CERAMIC	0.01		2KV
C054	CK45E3D102P	CAP. CERAMIC	1000P		2KV
C055	CK45B2H222K	CAP. CERAMIC	2200P	10%	500V
C056	CK45B2H222K	CAP. CERAMIC	2200P	10%	500V
C059	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C060	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C061	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C062	CK45B1H222K	CAP. CERAMIC	2200P	10%	50V
C063	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C064	C91-0571-05	CAP. CERAMIC	0.01		2KV
D001	1SS132	DIODE			
D002	MTZ12JC	DIODE, ZENER	12V		
D003	MTZ12JC	DIODE, ZENER	12V		
D004	MTZ3.3JA	DIODE, ZENER	3.2V		
D005	1SS132	DIODE			
D009	MTZ5.1JB	DIODE, ZENER	5.0V		
D010	1SS83	DIODE			
D011	1SS83	DIODE			
D012	W06C	DIODE			
D013	W06C	DIODE			
D014	W06C	DIODE			
D015	W06C	DIODE			
D016	1SS132	DIODE			
D017	1SS132	DIODE			
D018	UZ-3.0B	DIODE, ZENER	3.0V		
D019	UZ-6.2BL	DIODE, ZENER	6.2V		
D020	1SS132	DIODE			
D021	1SS132	DIODE			
D022	1SS83	DIODE			
IC001	NJM4558D	IC, OP AMP			
IC002	NJM4558D	IC, OP AMP			
IC003	LM340LAZ5.0	IC, REGULATOR			
L001	L40-1011-04	FERRI INDUCTOR	100UH (7H)		
L002	L40-1011-04	FERRI INDUCTOR	100UH (7H)		
L003	L40-1011-04	FERRI INDUCTOR	100UH (7H)		
L004	L40-1011-04	FERRI INDUCTOR	100UH (7H)		
L005	L40-1011-04	FERRI INDUCTOR	100UH (7H)		
L006	L40-1011-03	FERRI INDUCTOR	100UH (5H)		
NL001	NE-2B	NEON LAMP			
NL002	NE-2B	NEON LAMP			
NL003	NE-2B	NEON LAMP			
NL004	NE-2B	NEON LAMP			
P022	E40-0773-05	PIN CONNECTOR	7P		
P023	E40-0473-05	PIN CONNECTOR	4P		
P024	NO USE				
P025	E40-0273-05	PIN CONNECTOR	2P		
P026	E40-0573-05	PIN CONNECTOR	5P		
P027	E40-0873-05	PIN CONNECTOR	8P		
P028	E40-0473-05	PIN CONNECTOR	4P		
P029	E40-0703-05	PIN CONNECTOR	7P		
P030	E40-0746-05	PIN CONNECTOR	7P		
P031	NO USE				
P032	E40-0373-05	PIN CONNECTOR	3P		
P033	E40-0332-05	PIN CONNECTOR	3P		
P034	E40-0273-05	PIN CONNECTOR	2P		
P063	E40-0673-05	PIN CONNECTOR	6P		
Q001	2SC2591(Q,R)	TR. SI, NPN			
Q002	2SC1505(L)	TR. SI, NPN			
Q003	2SB633(E)	TR. SI, PNP			
Q004	2SD613(E)	TR. SI, NPN			
Q005	2SB633(E)	TR. SI, PNP			
Q006	2SC1505(L)	TR. SI, NPN			
Q007	2SC3311(R)	TR. SI, NPN			
Q008	2SC1505(L)	TR. SI, NPN			
Q009	2SC3311(R)	TR. SI, NPN			
Q010	2SA1309(Q,R)	TR. SI, PNP			
Q011	2SC3354(S,T)	TR. SI, NPN			
Q012	2SC3354(S,T)	TR. SI, NPN			
Q013	2SA1323(B,C)	TR. SI, PNP			
Q014	NO USE				
Q015	2SC3315(C,D)	TR. SI, NPN			
Q016	2SC3315(C,D)	TR. SI, NPN			
Q017	2SC3315(C,D)	TR. SI, NPN			
Q018	2SC2912(S)	TR. SI, NPN			
Q019	2SA1210(S)	TR. SI, PNP			
Q020	2SC2910(S,T)	TR. SI, NPN			
Q021	2SA1208(S,T)	TR. SI, PNP			
Q022	2SC2910(S,T)	TR. SI, NPN			
Q023	2SC2910(S,T)	TR. SI, NPN			
Q024	2SC3311(R)	TR. SI, NPN			
Q025	2SC3311(R)	TR. SI, NPN			
Q026	2SA1309(Q,R)	TR. SI, PNP			
Q027	2SK192A-BL	FET, N-CHANNEL			
Q028	2SD613(E)	TR. SI, NPN			
R001	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R002	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R003	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R004	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R005	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R006	RN14BK2C1303F	RES. METAL FILM	130K	1%	1/6W
R007	RN14BK2C5601F	RES. METAL FILM	5.6K	1%	1/6W
R008	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R009	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R010	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R011	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R012	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R013	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R014	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R015	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R016	RN14BK2C3901F	RES. METAL FILM	3.9K	1%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R017	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R018	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R019	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R020	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R021	RD14BB2E100J	RES. CARBON	10	5%	1/4W
R022	RN14BK2C1302F	RES. METAL FILM	13K	1%	1/6W
R023	RN14BK2C8201F	RES. METAL FILM	8.2K	1%	1/6W
R028	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R029	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R030	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R031	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R032	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R033	RN14BK2C9101F	RES. METAL FILM	9.1K	1%	1/6W
R034	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R035	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R036	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R037	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R038	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R039	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R040	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R041	RD14BB2E751J	RES. CARBON	750	5%	1/4W
R042	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R043	NO USE				
R044	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R045	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R046	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R047	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R048	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R049	RD14BB2C753J	RES. CARBON	75K	5%	1/6W
R050	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R051	RD14BB2C752J	RES. CARBON	7.5K	5%	1/6W
R052	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R053	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R054	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R055	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R056	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R057	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R058	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R059	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R060	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R061	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R062	RD14BB2C683J	RES. CARBON	68K	5%	1/6W
R063	RD14BB2C683J	RES. CARBON	68K	5%	1/6W
R064	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R065	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R066	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R067	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R068	RN14BK2C6802F	RES. METAL FILM	68K	1%	1/6W
R069	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R070	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R071	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R072	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R073	RD14BB2C680J	RES. CARBON	68	5%	1/6W
R074	R92-0793-05	RES. FIXED	15M	5%	1/2W
R075	R92-1027-05	RES. FIXED	8.2M	5%	1/2W
R076	R92-1051-05	RES. FIXED	4.7M	5%	1W
R077	R92-1413-05	RES. FIXED	9.1M	5%	1W
R078	R92-0755-05	RES. FIXED	3M	5%	1/2W
R079	R92-0756-05	RES. FIXED	47M	5%	1/2W
R080	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R081	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R082	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R083	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R084	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R085	RD14BB2C134J	RES. CARBON	130K	5%	1/6W
R086	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R087	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R088	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R091	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R092	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R093	RD14BB2C114J	RES. CARBON	110K	5%	1/6W
R094	RD14BB2C303J	RES. CARBON	30K	5%	1/6W
TC001	C05-0405-05	CAP. TRIMMER	20P		
TC002	C05-0439-05	CAP. TRIMMER	40P		
TC003	C05-0403-05	CAP. TRIMMER	2P		
VR001	R12-1028-05	RES. SEMI FIXED	4.7KB		
VR002	R12-3041-05	RES. SEMI FIXED	10KB		
VR003	R12-3042-05	RES. SEMI FIXED	47KB		
VR004	R05-8001-05	V.R.	3MB		
VR005	R03-3504-05	V.R. WITH SW	10KB		

FILTER UNIT

X70-1020-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E18-0364-05	AC INLET	3P		
	E23-0503-05	TERMINAL			
	J25-5038-72	PCB (UNMOUNTED)			
C001	C91-0551-05	CAP. POLYESTER	0.22	10%	630V
C002	C91-0575-05	CAP. CERAMIC	1000P		400V
C003	C91-0575-05	CAP. CERAMIC	1000P		400V
C004	CE04EW1H010M	CAP. ELECTRO	1	20%	50V
D001	1SS132	DIODE			
IC001	ON3101	IC. PHOTO COUPLER			
L001	L33-0808-05	CHOKE COIL			
P024	E40-0273-05	PIN CONNECTOR	2P		
R001	RD14BY2H224J	RES. CARBON	220K	5%	1/2W
R002	RD14BY2H225J	RES. CARBON	2.2M	5%	1/2W

VERTICAL PREAMP UNIT

X73-1500-04

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E23-0557-14	EARTH LUG			
	E29-0504-05	TEFLON TERMINAL			
	J25-5038-72	PCB (UNMOUNTED)			
	L92-0110-05	FERRITE BEADS			
	R92-0150-05	JUMPING RES.	ZERO OHM		
	002-0001-05	BRAIDED WIRE			
	212-2014-05	TUBE (PLASTIC)			
C001	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C002	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C003	CC45CH1H151J	CAP. CERAMIC	150P	5%	50V
C004	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C005	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C006	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C007	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C008	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C009	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C010	CM93BD2A680J	CAP. MICA	68P	5%	100V
C011	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C012	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C013	CK45B1H472K	CAP. CERAMIC	4700P	10%	50V
C014	CC45CH1H020C	CAP. CERAMIC	2P	0.25P	50V
C015	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C016	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C017	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C018	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C019	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C020	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C021	NO USE				
C022	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C023	NO USE				
C024	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C025	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C026	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C027	CC45CH1H390J	CAP. CERAMIC	39P	5%	50V
C028	CC45CH1H050C	CAP. CERAMIC	5P	0.25P	50V
C029	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C030	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C031	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C032	C092FM1H104K	CAP. MYLAR	0.1	10%	50V
C033	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C034	CC45SL1H101J	CAP. CERAMIC	100P	5%	50V
C035	CC45SL1H470J	CAP. CERAMIC	47P	5%	50V
C036	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C037	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C038	CC45CH1H151J	CAP. CERAMIC	150P	5%	50V
C039	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C040	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C041	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C042	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C043	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C044	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C045	CM93BD2A680J	CAP. MICA	68P	5%	100V
C046	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C047	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C048	CK45B1H472K	CAP. CERAMIC	4700P	10%	50V
C049	CC45CH1H020C	CAP. CERAMIC	2P	0.25P	50V
C050	CK45F1H103Z	CAP. CERAMIC	0.01		50V

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
C051	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C052	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C053	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C054	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C055	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C058	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C059	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C060	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C061	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C062	CC45CH1H330J	CAP. CERAMIC	33P	5%	50V
C063	NO USE				
C064	CC45CH1H120J	CAP. CERAMIC	12P	5%	50V
C065	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C066	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C067	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C068	CC45SL1H470J	CAP. CERAMIC	47P	5%	50V
C071	CC45CH1H020C	CAP. CERAMIC	2P	0.25P	50V
C072	CC45CH1H020C	CAP. CERAMIC	2P	0.25P	50V
C075	CC45SL1H151J	CAP. CERAMIC	150P	5%	50V
C076	CC45SL1H151J	CAP. CERAMIC	150P	5%	50V
C077	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C080	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C088	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C089	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C090	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C091	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C092	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C093	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C094	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C095	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C096	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C097	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C098	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C099	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C100	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C101	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C102	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C103	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C104	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C105	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C106	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C107	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C108	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C109	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C110	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C111	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C112	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C113	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C114	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C115	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C116	NO USE				
C117	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C118	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C119	NO USE				
C120	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C121	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C122	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C123	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C124	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C128	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C132	CC45SL1H101J	CAP. CERAMIC	100P	5%	50V
C135	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C140	CC45CH1H050C	CAP. CERAMIC	5P	0.25P	50V
C141	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C142	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C145	CC45CH1H050C	CAP. CERAMIC	5P	0.25P	50V
C148	CC45CH1H020C	CAP. CERAMIC	2P	0.25P	50V
C149	CC45CH1H020C	CAP. CERAMIC	2P	0.25P	50V
C150	CC45CH1H020C	CAP. CERAMIC	2P	0.25P	50V
C153	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C154	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C155	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C156	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C157	CC45CH1H220J	CAP. CERAMIC	22P	5%	50V
C158	CC45CH1H220J	CAP. CERAMIC	22P	5%	50V
C159	CC45CH1H030C	CAP. CERAMIC	3P	0.25P	50V
C160	CC45CH1H030C	CAP. CERAMIC	3P	0.25P	50V

REF.NO	PARTS NO	NAME & DESCRIPTION	
D001	1S1544A	DIODE	
D002	1S1544A	DIODE	
D003	MTZ3.3JA	DIODE, ZENER	3.2V
D004	1SS132	DIODE	
D005	1SS132	DIODE	
D006	1SS132	DIODE	
D007	1SS132	DIODE	
D008	1SS132	DIODE	
D009	1SS132	DIODE	
D010	1SS132	DIODE	
D011	MTZ3.3JA	DIODE, ZENER	3.2V
D012	MTZ3.3JA	DIODE, ZENER	3.2V
D013	1S1544A	DIODE	
D014	1S1544A	DIODE	
D015	MTZ3.3JA	DIODE, ZENER	3.2V
D016	1SS132	DIODE	
D017	1SS132	DIODE	
D018	MTZ7.5JA	DIODE, ZENER	7.1V
D019	1N60	DIODE	
D020	1SS132	DIODE	
D021	1SS132	DIODE	
D022	1SS132	DIODE	
D023	1SS132	DIODE	
D024	1SS132	DIODE	
D025	MTZ3.3JA	DIODE, ZENER	3.2V
D026	MTZ7.5JA	DIODE, ZENER	7.1V
D027	1SS132	DIODE	
D028	MTZ7.5JA	DIODE, ZENER	7.1V
D037	1SS132	DIODE	
D038	1SS132	DIODE	
D039	1SS132	DIODE	
D040	1SS132	DIODE	
D041	1SS132	DIODE	
D046	1SS132	DIODE	
D047	1SS132	DIODE	
D048	1SS132	DIODE	
D049	1SS132	DIODE	
IC001	LF441ACN	IC, LOW-POWER JFET OP AMP	
IC002	LF441ACN	IC, LOW-POWER JFET OP AMP	
IC003	SN7400N	IC, QUAD 2 INPUT NAND GATE	
IC004	MC10104L	IC, QUAD 2-INPUT AND GATE	
IC005	MC10131L	IC, DUAL D-FLIP FLOP	
IC006	NO USE		
IC007	MC10102L	IC, QUAD 2-INPUT NOR GATE	
IC008	LM337LZ	IC, REGULATOR	
IC009	LM317LZ	IC, REGULATOR	
L001	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L002	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L003	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L004	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L005	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L006	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L007	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L008	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L009	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L010	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L011	L40-1011-04	FERRI INDUCTOR	100UH (7H)
L012	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L013	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L014	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L015	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L016	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L017	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L018	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L019	NO USE		
L020	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L021	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L022	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
L023	L40-4791-02	FERRI INDUCTOR	4.7UH (4H)
P001	E40-0473-05	PIN CONNECTOR	4P
P002	E40-1273-05	PIN CONNECTOR	12P
P003	E40-0473-05	PIN CONNECTOR	4P
P004	E40-0473-05	PIN CONNECTOR	4P
P007	E40-0573-05	PIN CONNECTOR	5P
P008	E40-0573-05	PIN CONNECTOR	5P
P009	E40-0315-05	PIN CONNECTOR	3P
P014	E40-0573-05	PIN CONNECTOR	5P
P015	E40-0273-05	PIN CONNECTOR	2P
P016	E40-0273-05	PIN CONNECTOR	2P
P019	E40-0273-05	PIN CONNECTOR	2P
P020	E40-0573-05	PIN CONNECTOR	5P

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
P021	E40-0273-05	PIN CONNECTOR 2P
Q001	J304	FET. N-CHANNEL
Q002	2SC2671(H)	TR. SI. NPN
Q003	2SC2671(H)	TR. SI. NPN
Q004	2SC2671(H)	TR. SI. NPN
Q005	2SC2671(H)	TR. SI. NPN
Q006	2SC3354(S,T)	TR. SI. NPN
Q007	2SC3354(S,T)	TR. SI. NPN
Q008	2SC3066	TR. SI. NPN-DUAL
Q009	2SC3354(S,T)	TR. SI. NPN
Q010	2SC3354(S,T)	TR. SI. NPN
Q011	2SC3354(S,T)	TR. SI. NPN
Q012	2SC3354(S,T)	TR. SI. NPN
Q013	2SC3315(C,D)	TR. SI. NPN
Q014	2SC3311(R)	TR. SI. NPN
Q015	2SA1161	TR. SI. PNP
Q016	2SA1161	TR. SI. PNP
Q017	2SC3311(R)	TR. SI. NPN
Q018	2SA1323(B,C)	TR. SI. PNP
Q019	2SA1323(B,C)	TR. SI. PNP
Q020	2SC3354(S,T)	TR. SI. NPN
Q021	2SC3354(S,T)	TR. SI. NPN
Q022	2SC2671(H)	TR. SI. NPN
Q023	2SC2671(H)	TR. SI. NPN
Q024	2SC2671(H)	TR. SI. NPN
Q025	2SC2671(H)	TR. SI. NPN
Q026	2SC3315(C,D)	TR. SI. NPN
Q027	2SC3315(C,D)	TR. SI. NPN
Q028	2SC3354(S,T)	TR. SI. NPN
Q029	2SC3354(S,T)	TR. SI. NPN
Q030	J304	FET. N-CHANNEL
Q031	2SC2671(H)	TR. SI. NPN
Q032	2SC2671(H)	TR. SI. NPN
Q033	2SC2671(H)	TR. SI. NPN
Q034	2SC2671(H)	TR. SI. NPN
Q035	2SC3354(S,T)	TR. SI. NPN
Q036	2SC3354(S,T)	TR. SI. NPN
Q037	2SC3066	TR. SI. NPN-DUAL
Q038	2SC3354(S,T)	TR. SI. NPN
Q039	2SC3354(S,T)	TR. SI. NPN
Q040	2SC3354(S,T)	TR. SI. NPN
Q041	2SC3354(S,T)	TR. SI. NPN
Q042	2SC3315(C,D)	TR. SI. NPN
Q043	2SC3311(R)	TR. SI. NPN
Q044	2SA1161	TR. SI. PNP
Q045	2SA1161	TR. SI. PNP
Q046	2SA1161	TR. SI. PNP
Q047	2SA1161	TR. SI. PNP
Q048	2SC3311(R)	TR. SI. NPN
Q049	2SA1309(Q,R)	TR. SI. PNP
Q050	2SA1309(Q,R)	TR. SI. PNP
Q051	2SC3311(R)	TR. SI. NPN
Q052	2SA1323(B,C)	TR. SI. PNP
Q053	2SA1323(B,C)	TR. SI. PNP
Q054	2SC3354(S,T)	TR. SI. NPN
Q055	2SC3354(S,T)	TR. SI. NPN
Q056	2SC2671(H)	TR. SI. NPN
Q057	2SC2671(H)	TR. SI. NPN
Q058	2SC2671(H)	TR. SI. NPN
Q059	2SC2671(H)	TR. SI. NPN
Q060	2SC3315(C,D)	TR. SI. NPN
Q061	2SC3354(S,T)	TR. SI. NPN
Q062	2SC3354(S,T)	TR. SI. NPN
Q063	2SC3354(S,T)	TR. SI. NPN
Q064	2SA1309(Q,R)	TR. SI. PNP
Q065	2SC3354(S,T)	TR. SI. NPN
Q066	2SC3354(S,T)	TR. SI. NPN
Q067	2SA1161	TR. SI. PNP
Q068	2SA1161	TR. SI. PNP
Q069	2SC3315(C,D)	TR. SI. NPN
Q070	2SC3315(C,D)	TR. SI. NPN
Q071	2SA1309(Q,R)	TR. SI. PNP
Q072	2SC3311(R)	TR. SI. NPN
Q073	2SA1161	TR. SI. PNP
Q074	2SA1161	TR. SI. PNP
Q081	2SC3311(R)	TR. SI. NPN
Q082	2SA1309(Q,R)	TR. SI. PNP
Q083	2SA1309(Q,R)	TR. SI. PNP
R001	RD14BB2E684J	RES. CARBON 680K 5% 1/4W
R002	RN14BK2E1803D	RES. METAL FILM 180K 0.5% 1/4W
R003	RN14BK2E8203D	RES. METAL FILM 820K 0.5% 1/4W
R004	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R005	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R006	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R007	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R008	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W

REF.NO	PARTS NO	NAME & DESCRIPTION
R009	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R010	RD14BB2C271J	RES. CARBON 270 5% 1/6W
R011	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R012	RN14BK2C5600F	RES. METAL FILM 560 1% 1/6W
R013	RN14BK2C1100F	RES. METAL FILM 110 1% 1/6W
R014	RN14BK2C5600F	RES. METAL FILM 560 1% 1/6W
R015	RN14BK2C3901F	RES. METAL FILM 3.9K 1% 1/6W
R016	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R017	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R018	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R019	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R020	RD14BB2C821J	RES. CARBON 820 5% 1/6W
R021	R92-1061-05	JUMPING RES. ZERO OHM
R022	R92-1061-05	JUMPING RES. ZERO OHM
R023	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R024	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R025	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R026	RN14BK2C4702F	RES. METAL FILM 47K 1% 1/6W
R027	RN14BK2C8200F	RES. METAL FILM 820 1% 1/6W
R028	RN14BK2C3001F	RES. METAL FILM 3K 1% 1/6W
R029	RD14BB2C474J	RES. CARBON 470K 5% 1/6W
R030	RD14BB2C680J	RES. CARBON 68 5% 1/6W
R031	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R032	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R033	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R034	RD14BB2C680J	RES. CARBON 68 5% 1/6W
R035	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R036	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R037	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R038	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R039	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R040	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R041	RD14BB2C622J	RES. CARBON 6.2K 5% 1/6W
R042	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R043	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R044	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R045	RD14BB2C201J	RES. CARBON 200 5% 1/6W
R046	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R047	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R048	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R049	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R050	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R051	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R052	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R053	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R054	RN14BK2C3300F	RES. METAL FILM 330 1% 1/6W
R055	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R056	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
R057	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R058	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R059	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R060	NO USE	
R061	RN14BK2C3300F	RES. METAL FILM 330 1% 1/6W
R062	RN14BK2C6200F	RES. METAL FILM 620 1% 1/6W
R063	RN14BK2C6200F	RES. METAL FILM 620 1% 1/6W
R064	RD14BB2C391J	RES. CARBON 390 5% 1/6W
R065	RD14BB2C821J	RES. CARBON 820 5% 1/6W
R066	RD14BB2C821J	RES. CARBON 820 5% 1/6W
R067	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R068	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R069	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R070	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R071	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R072	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R073	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R074	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R075	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R076	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R077	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R078	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R079	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R080	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R081	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R082	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R083	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W
R084	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R085	RN14BK2C1200F	RES. METAL FILM 120 1% 1/6W
R086	RN14BK2C7500F	RES. METAL FILM 750 1% 1/6W
R087	RN14BK2C7500F	RES. METAL FILM 750 1% 1/6W
R088	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R089	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R090	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R091	RD14BB2C223J	RES. CARBON 22K 5% 1/6W
R092	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R093	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R094	RD14BB2C681J	RES. CARBON 680 5% 1/6W
R095	RD14BB2C681J	RES. CARBON 680 5% 1/6W
R096	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R097	NO USE	

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R098	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R099	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R100	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R101	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R102	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R103	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R104	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R105	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R106	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R107	RD14BB2C330J	RES. CARBON	33	5%	1/6W
R108	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R109	RD14BB2C330J	RES. CARBON	33	5%	1/6W
R110	RD14BB2E684J	RES. CARBON	680K	5%	1/4W
R111	RN14BK2E1803D	RES. METAL FILM	180K	0.5%	1/4W
R112	RN14BK2E8203D	RES. METAL FILM	820K	0.5%	1/4W
R113	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R114	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R115	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R116	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R117	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R118	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R119	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R120	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R121	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R122	RN14BK2C1100F	RES. METAL FILM	110	1%	1/6W
R123	RN14BK2C5600F	RES. METAL FILM	560	1%	1/6W
R124	RN14BK2C3901F	RES. METAL FILM	3.9K	1%	1/6W
R125	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R126	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R127	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R128	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R129	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R130	R92-1061-05	JUMPING RES.	ZERO OHM		
R131	R92-1061-05	JUMPING RES.	ZERO OHM		
R132	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R133	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R134	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R135	RN14BK2C4702F	RES. METAL FILM	47K	1%	1/6W
R136	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R137	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R138	RD14BB2C474J	RES. CARBON	470K	5%	1/6W
R139	RD14BB2C680J	RES. CARBON	68	5%	1/6W
R140	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R141	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R142	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R143	RD14BB2C680J	RES. CARBON	68	5%	1/6W
R144	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R145	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R146	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R147	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R148	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R149	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R150	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R151	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R152	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R153	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R154	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R155	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R156	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R157	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R158	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R159	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R160	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R161	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R162	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R163	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R164	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R165	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R166	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R167	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R168	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R169	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R170	NO USE				
R171	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R172	RN14BK2C6200F	RES. METAL FILM	620	1%	1/6W
R173	RN14BK2C6200F	RES. METAL FILM	620	1%	1/6W
R174	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R175	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R176	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R177	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R178	NO USE				
R179	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R180	RN14BK2C6200F	RES. METAL FILM	620	1%	1/6W
R181	RN14BK2C6200F	RES. METAL FILM	620	1%	1/6W
R182	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R183	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R184	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R185	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R186	RD14BB2C103J	RES. CARBON	10K	5%	1/6W

REF.NO	PARTS NO	NAME & DESCRIPTION			
R187	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R188	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R189	NO USE				
R190	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R191	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R192	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R193	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R194	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R195	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R196	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R197	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R198	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R199	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R200	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R201	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R202	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R203	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R204	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R205	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R206	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R207	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R208	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R209	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R210	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R211	RN14BK2C1200F	RES. METAL FILM	120	1%	1/6W
R212	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R213	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R214	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R215	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R216	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R217	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R218	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R219	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R220	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R221	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R222	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R223	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R224	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R225	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R226	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R227	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R228	RD14BB2C330J	RES. CARBON	33	5%	1/6W
R229	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R230	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R231	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R232	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R233	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R234	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R235	RD14BB2C820J	RES. CARBON	82	5%	1/6W
R236	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R237	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R238	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R239	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R240	RD14BB2C820J	RES. CARBON	82	5%	1/6W
R241	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R242	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R243	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R244	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R245	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R246	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R247	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R248	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R249	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R250	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R251	RN14BK2C75R0F	RES. METAL FILM	75.0	1%	1/6W
R252	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R253	RN14BK2C75R0F	RES. METAL FILM	75.0	1%	1/6W
R254	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R255	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R256	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R257	NO USE				
R258	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R259	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R260	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R261	NO USE				
R262	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R263	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R264	RN14BK2C3900F	RES. METAL FILM	390	1%	1/6W
R265	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R266	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R267	RN14BK2C3900F	RES. METAL FILM	390	1%	1/6W
R268	NO USE				
R269	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R270	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R271	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R298	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R299	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R300	RD14BB2C153J	RES. CARBON	15K	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R301	NO USE				
R302	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R303	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R304	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R305	NO USE				
R306	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R307	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R308	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R309	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R310	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R311	NO USE				
R312	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R313	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R314	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R315	RD14BB2C270J	RES. CARBON	27	5%	1/6W
R316	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R317	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R318	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R319	RD14BB2C270J	RES. CARBON	27	5%	1/6W
R320	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R329	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R330	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R331	RN14BK2C2400F	RES. METAL FILM	240	1%	1/6W
R332	RN14BK2C1101F	RES. METAL FILM	1.1K	1%	1/6W
R333	RN14BK2C2400F	RES. METAL FILM	240	1%	1/6W
R334	RN14BK2C1101F	RES. METAL FILM	1.1K	1%	1/6W
R338	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R339	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R340	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R341	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R344	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R350	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R351	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R352	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R353	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R354	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R355	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R356	NO USE				
R357	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R358	RD14BB2C430J	RES. CARBON	43	5%	1/6W
TC001	C05-0309-05	CAP. TRIMMER	40P		
TC002	C05-0031-15	CAP. TRIMMER	10P		
TC003	C05-0031-15	CAP. TRIMMER	10P		
TC004	C05-0309-05	CAP. TRIMMER	40P		
TC005	C05-0309-05	CAP. TRIMMER	40P		
TC006	C05-0031-15	CAP. TRIMMER	10P		
TC007	C05-0031-15	CAP. TRIMMER	10P		
TP003	E40-0211-05	PIN CONNECTOR	2P		
VR001	R12-0540-05	RES. SEMI FIXED	500B		
VR002	R12-3520-05	RES. SEMI FIXED	10KB		
VR003	NO USE				
VR004	R12-0421-05	RES. SEMI FIXED	100B		
VR005	R12-0421-05	RES. SEMI FIXED	100B		
VR006	R12-0421-05	RES. SEMI FIXED	100B		
VR007	R12-0421-05	RES. SEMI FIXED	100B		
VR008	R12-0539-05	RES. SEMI FIXED	200B		
VR009	R12-3520-05	RES. SEMI FIXED	10KB		
VR010	NO USE				
VR011	R12-0540-05	RES. SEMI FIXED	500B		
VR012	R12-3520-05	RES. SEMI FIXED	10KB		
VR013	NO USE				
VR014	R12-0421-05	RES. SEMI FIXED	100B		
VR015	R12-0421-05	RES. SEMI FIXED	100B		
VR016	R12-0421-05	RES. SEMI FIXED	100B		
VR017	R12-0421-05	RES. SEMI FIXED	100B		
VR018	R12-0421-05	RES. SEMI FIXED	100B		
VR019	R12-3520-05	RES. SEMI FIXED	10KB		
VR020	R12-0539-05	RES. SEMI FIXED	200B		
VR025	R12-0539-05	RES. SEMI FIXED	200B		

VERTICAL OUTPUT AMP UNIT

X73-1510-04

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E23-0512-05	TERMINAL			
	F02-0502-04	HEAT SINK			
	F02-0513-04	HEAT SINK			
	J25-5039-52	PCB (UNMOUNTED)			
	L92-0110-05	FERRITE BEADS			
	N09-0709-05	SCREW, WITH WASHER			
	N89-3008-41	SCREW, BINDING TAP TITE M3X8			
	212-1018-05	TUBE (PLASTIC)			
	212-2014-05	TUBE (PLASTIC)			
	420-0010-05	ADHESIVES			
	490-0010-05	TAPE, MYLAR			
C001	CC45CH1H470J	CAP. CERAMIC	47P	5%	50V
C002	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C003	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C004	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C005	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C006	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C007	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C008	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C009	NO USE				
C010	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C011	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C012	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C013	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C014	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C015	CE04EW1V330M	CAP. ELECTRO	33	20%	35V
C016	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C017	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C018	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C019	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C020	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C021	NO USE				
C022	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C023	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C024	CC45SL1H331J	CAP. CERAMIC	330P	5%	50V
C025	CC45SL1H331J	CAP. CERAMIC	330P	5%	50V
C026	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C027	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C028	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
D002	1SV71	DIODE, VARIABLE CAPACITANCE			
D003	1SV71	DIODE, VARIABLE CAPACITANCE			
D004	MTZ7.5JC	DIODE, ZENER	7.5V		
L001	L33-0806-05	CHOKE COIL (0.52UH)			
L002	L33-0806-05	CHOKE COIL (0.52UH)			
L005	L40-4701-03	FERRI INDUCTOR	47UH (5H)		
L006	L40-4701-03	FERRI INDUCTOR	47UH (5H)		
L007	L40-4701-03	FERRI INDUCTOR	47UH (5H)		
L008	L40-4701-03	FERRI INDUCTOR	47UH (5H)		
L009	NO USE				
P010	E40-0315-05	PIN CONNECTOR	3P		
P013	E40-0273-05	PIN CONNECTOR	2P		
P020	E40-0573-05	PIN CONNECTOR	5P		
P021	NO USE				
P022	E40-0773-05	PIN CONNECTOR	7P		
Q001	2SC2671(H)	TR. SI, NPN			
Q002	2SC2671(H)	TR. SI, NPN			
Q003	2SA1206	TR. SI, PNP			
Q004	2SA1206	TR. SI, PNP			
Q005	2SC2671(H)	TR. SI, NPN			
Q006	2SC2671(H)	TR. SI, NPN			
Q007	2SC2644	TR. SI, NPN			
Q008	2SC2644	TR. SI, NPN			
Q009	2SC2644	TR. SI, NPN			
Q010	2SC2644	TR. SI, NPN			
Q011	2SC1164(O)*S	TR. SI, NPN			
Q012	2SC1164(O)*S	TR. SI, NPN			
Q013	NO USE				
Q014	2SC3311(Q,R)	TR. SI, NPN			
Q015	2SA1309(Q,R)	TR. SI, PNP			
Q016	2SA1309(Q,R)	TR. SI, PNP			
Q017	2SC3311(Q,R)	TR. SI, NPN			
R002	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R003	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R004	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R005	RN14BK2C75R0F	RES. METAL FILM	75.0	1%	1/6W
R006	RN14BK2C75R0F	RES. METAL FILM	75.0	1%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R007	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R008	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R009	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R010	RN14BK2E3900F	RES. METAL FILM	390	1%	1/4W
R011	RN14BK2E3900F	RES. METAL FILM	390	1%	1/4W
R012	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R013	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R014	RD14BB2E361J	RES. CARBON	360	5%	1/4W
R015	RD14BB2E361J	RES. CARBON	360	5%	1/4W
R016	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R017	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R018	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R019	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R020	NO USE				
R021	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R022	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R023	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R024	RN14BK2E36R0F	RES. METAL FILM	36.0	1%	1/4W
R025	RN14BK2E36R0F	RES. METAL FILM	36.0	1%	1/4W
R026	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R027	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R028	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R029	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R030	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R031	RS14AB3H471J	RES. METAL FILM	470	5%	5W
R032	RS14AB3H471J	RES. METAL FILM	470	5%	5W
R037	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R038	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R039	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R040	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R041	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R042	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R043	RN14BK2C47R0F	RES. METAL FILM	47.0	1%	1/6W
R044	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R045	RN14BK2C47R0F	RES. METAL FILM	47.0	1%	1/6W
R046	RN14BK2C91R0F	RES. METAL FILM	91.0	1%	1/6W
R047	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R048	RN14BK2C2701F	RES. METAL FILM	2.7K	1%	1/6W
R049	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R050	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R051	NO USE				
R052	R92-1061-05	JUMPING RES.	ZERO OHM		
R053	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R054	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R055	RD14BB2C911J	RES. CARBON	910	5%	1/6W
R056	RD14BB2C911J	RES. CARBON	910	5%	1/6W
R057	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R058	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R059	NO USE				
R060	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R061	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
TC001	C05-0412-05	CAP. TRIMMER	20P		
TC002	C05-0412-05	CAP. TRIMMER	20P		
TH001	SDT1000	THERMISTOR			
VR001	R12-0567-05	RES. SEMI FIXED	500B		
VR002	R12-0567-05	RES. SEMI FIXED	500B		
VR003	R12-0567-05	RES. SEMI FIXED	500B		

SWEEP ROTARY UNIT

X74-1310-03

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-2971-13	PCB (UNMOUNTED)			
D001	1SS132	DIODE			
D002	1SS135	DIODE			
D003	1SS135	DIODE			
D004	1SS135	DIODE			
D005	1SS135	DIODE			
D006	1SS135	DIODE			
D007	1SS135	DIODE			
D008	1SS135	DIODE			
J040	E31-2507-05	LEAD WIRE WITH CONNECTOR			
J041	E31-2508-05	LEAD WIRE WITH CONNECTOR			
J057	E31-2509-25	LEAD WIRE WITH CONNECTOR			
R001	RN14BK2C3603F	RES. METAL FILM	360K	1%	1/6W
R002	RN14BK2C1203F	RES. METAL FILM	120K	1%	1/6W
R003	RN14BK2C3002F	RES. METAL FILM	30K	1%	1/6W
R004	RN14BK2C3002F	RES. METAL FILM	30K	1%	1/6W
R005	RN14BK2C3602F	RES. METAL FILM	36K	1%	1/6W
R006	RN14BK2C1202F	RES. METAL FILM	12K	1%	1/6W
R007	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R008	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R009	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R010	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R011	RD14BB2C393J	RES. CARBON	39K	5%	1/6W
R012	RD14BB2C203J	RES. CARBON	20K	5%	1/6W
R013	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R014	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R015	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R016	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R017	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R018	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R019	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R020	RN14BK2C3603F	RES. METAL FILM	360K	1%	1/6W
R021	RN14BK2C1203F	RES. METAL FILM	120K	1%	1/6W
R022	RN14BK2C3002F	RES. METAL FILM	30K	1%	1/6W
R023	RN14BK2C3002F	RES. METAL FILM	30K	1%	1/6W
R024	RN14BK2C3602F	RES. METAL FILM	36K	1%	1/6W
R025	RN14BK2C1202F	RES. METAL FILM	12K	1%	1/6W
R026	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R027	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R028	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R036	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R037	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R038	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
S001	S02-2513-05	ROTARY SWITCH			
S002	S02-2513-05	ROTARY SWITCH			
VR001	S02-2513-05	ROTARY SWITCH			

TRIG SWEEP UNIT

X74-1350-02

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5039-52	PCB (UNMOUNTED)			
	J61-0408-05	WIRE WRAPPING BAND			
	R92-0150-05	JUMPING RES.	ZERO OHM		
	212-1018-05	TUBE (PLASTIC)			
	212-2014-05	TUBE (PLASTIC)			
	420-0008-05	ADHESIVES			
C001	CC45SL1H330J	CAP. CERAMIC	33P	5%	50V
C002	CE04EW1E100M	CAP. ELECTRO	10	20%	25V
C003	CE04EW1E100M	CAP. ELECTRO	10	20%	25V
C004	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C005	C91-0549-05	CAP. TANTALUM	1	20%	35V
C006	NO USE				
C007	CE04EW1V220M	CAP. ELECTRO	22	20%	35V
C008	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C009	C91-0549-05	CAP. TANTALUM	1	20%	35V
C010	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C011	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C012	CE04EW1H4R7M	CAP. ELECTRO	4.7	20%	50V
C013	C91-0583-05	CAP. PLASTIC	10	10%	
C014	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C015	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C016	CQ93M1H473K	CAP. MYLAR	0.047	10%	50V
C017	CQ93BP2A104F	CAP. MYLAR	0.1	1%	100V
C018	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C019	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C020	CC45SL1H331J	CAP. CERAMIC	330P	5%	50V
C021	CQ93BP2A102F	CAP. MYLAR	1000P	1%	100V
C022	NO USE				
C023	CM93BD2A101J	CAP. MICA	100P	5%	100V
C024	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C025	CC45SL1H471J	CAP. CERAMIC	470P	5%	50V
C026	NO USE				
C027	C91-0549-05	CAP. TANTALUM	1	20%	35V
C028	CC45SL1H330J	CAP. CERAMIC	33P	5%	50V
C029	CC45SL1H330J	CAP. CERAMIC	33P	5%	50V
C030	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C034	C91-0549-05	CAP. TANTALUM	1	20%	35V
C035	NO USE				
C036	CE04EW1V220M	CAP. ELECTRO	22	20%	35V
C037	C91-0549-05	CAP. TANTALUM	1	20%	35V
C038	NO USE				
C039	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C040	NO USE				
C041	C91-0583-05	CAP. PLASTIC	10	10%	
C042	NO USE				
C043	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C044	NO USE				

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
C045	CQ93BP2A104F	CAP. MYLAR	0.1	1%	100V
C046	NO USE				
C047	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C048	NO USE				
C049	CQ93BP2A102F	CAP. MYLAR	1000P	1%	100V
C053	CM93BD2A101J	CAP. MICA	100P	5%	100V
C054	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C055	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C056	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C057	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C058	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C059	CK45B1H681K	CAP. CERAMIC	680P	10%	50V
C060	CM93BD2A470J	CAP. MICA	47P	5%	100V
C061	CM93BD2A390J	CAP. MICA	39P	5%	100V
C062	CC45SL1H220J	CAP. CERAMIC	22P	5%	50V
C063	CQ93M1H102J	CAP. MYLAR	1000P	5%	50V
C064	CQ93M1H102J	CAP. MYLAR	1000P	5%	50V
C065	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C066	CQ93M1H472K	CAP. MYLAR	4700P	10%	50V
C067	CQ93M1H472K	CAP. MYLAR	4700P	10%	50V
C068	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C069	NO USE				
C070	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C071	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C072	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C073	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C074	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C075	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C076	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C077	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C078	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C079	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C080	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C081	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C082	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C083	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C084	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C085	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C086	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C087	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C088	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C089	CE04EW1A221M	CAP. ELECTRO	220	20%	10V
C090	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C091	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C092	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C093	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C094	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C095	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C096	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C097	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C098	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C099	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C100	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C101	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C102	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C103	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C104	CE04EW1E220M	CAP. ELECTRO	22	20%	25V
C105	CE04EW1E220M	CAP. ELECTRO	22	20%	25V
C106	CE04EW1E220M	CAP. ELECTRO	22	20%	25V
C107	CE04EW1E101M	CAP. ELECTRO	100	20%	25V
C108	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C109	CE04EW1E330M	CAP. ELECTRO	33	20%	25V
C110	CE04EW1J4R7M	CAP. ELECTRO	4.7	20%	63V
C111	CE04EW1J100M	CAP. ELECTRO	10	20%	63V
C112	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C113	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C114	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C115	NO USE				
C116	CE04EW1C470M	CAP. ELECTRO	47	20%	16V
C117	CC45SL1H220J	CAP. CERAMIC	22P	5%	50V
C118	CC45SL1H331J	CAP. CERAMIC	330P	5%	50V
C119	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	1SS132	DIODE			
D005	MTZ3.0JB	DIODE, ZENER	3.0V		
D006	1SS132	DIODE			
D007	1SS132	DIODE			
D008	1SS132	DIODE			
D009	MA700	DIODE			
D010	1SS132	DIODE			
D011	1SS132	DIODE			
D012	1SS132	DIODE			
D013	MTZ16JA	DIODE, ZENER	15V		
D014	1SS132	DIODE			
D015	1SS132	DIODE			
D016	1SS132	DIODE			

REF.NO	PARTS NO	NAME & DESCRIPTION
D017	1SS132	DIODE
D018	1SS132	DIODE
D019	1SS132	DIODE
D020	1SS132	DIODE
D021	1SS16	DIODE
D022	1SS132	DIODE
D023	1SS132	DIODE
D024	1SS132	DIODE
D025	1SS132	DIODE
D026	NO USE	
D027	1SS132	DIODE
D028	1SS132	DIODE
D029	NO USE	
D030	1SS132	DIODE
D034	1SS132	DIODE
D035	NO USE	
D036	1SS132	DIODE
D037	1SS132	DIODE
D038	1SS132	DIODE
D039	MA700	DIODE
D040	1SS132	DIODE
D041	1SS132	DIODE
D042	1SS132	DIODE
D043	MTZ16JA	DIODE, ZENER 15V
D047	1SS132	DIODE
D048	1SS132	DIODE
D049	1SS132	DIODE
D050	1SS132	DIODE
D051	1SS132	DIODE
D052	1SS132	DIODE
D053	MTZ12JC	DIODE, ZENER 12V
D054	MTZ12JC	DIODE, ZENER 12V
D055	SV06YS	DIODE, SILICON VARISTOR
D056	1S1587	DIODE
D057	1S1587	DIODE
D058	1S1587	DIODE
D059	1S1587	DIODE
D060	SV06YS	DIODE, SILICON VARISTOR
D061	1SS132	DIODE
D066	1SS132	DIODE
D067	1SS132	DIODE
D068	1SS132	DIODE
D069	1SS132	DIODE
D070	NO USE	
D071	1SS132	DIODE
D072	1SS132	DIODE
D073	1N60	DIODE
D074	1SS132	DIODE
D075	1SS132	DIODE
D076	1SS132	DIODE
D077	1SS132	DIODE
IC001	MC10H103L	IC, QUAD 2-INPUT OR GATE
IC002	MC10H131L	IC, DUAL D-FLIP FLOP
IC003	LF412CN	IC, DUAL JFET INPUT OP AMP
IC004	NO USE	
IC005	MC10H131L	IC, DUAL D-FLIP FLOP
IC006	LF412CN	IC, DUAL JFET INPUT OP AMP
IC007	MC10104L	IC, QUAD 2-INPUT AND GATE
IC008	MC10103L	IC, QUAD 2-INPUT OR GATE
IC009	NO USE	
IC010	MC10104L	IC, QUAD 2-INPUT AND GATE
IC011	MC10104L	IC, QUAD 2-INPUT AND GATE
IC012	MC10102L	IC, QUAD 2-INPUT NOR GATE
IC013	MC10131L	IC, DUAL D-FLIP FLOP
IC014	SN7406N	IC, HEX INVERTER
IC015	MC10104L	IC, QUAD 2-INPUT AND GATE
IC016	NO USE	
IC017	MC78L15ACP	IC, VOLTAGE REGULATOR (5V)
L001	L40-3392-01	FERRI INDUCTOR 3.3UH (3H)
L002	L40-3392-01	FERRI INDUCTOR 3.3UH (3H)
L003	L40-2201-03	FERRI INDUCTOR 22UH (5H)
P013	E40-0273-05	PIN CONNECTOR 2P
P014	E40-0573-05	PIN CONNECTOR 5P
P028	E40-0473-05	PIN CONNECTOR 4P
P035	E40-0473-05	PIN CONNECTOR 4P
P036	E40-0673-05	PIN CONNECTOR 6P
P037	E40-0773-05	PIN CONNECTOR 7P
P038	E40-0373-05	PIN CONNECTOR 3P
P039	E40-0773-05	PIN CONNECTOR 7P
P040	E40-0873-05	PIN CONNECTOR 8P
P041	E40-0873-05	PIN CONNECTOR 8P

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
P042	NO USE	
P043	E40-0273-05	PIN CONNECTOR 2P
P046	E40-0274-05	PIN CONNECTOR 2P
P047	E40-0573-05	PIN CONNECTOR 5P
P048	E40-1811-05	PIN CONNECTOR 18P
P052	E40-0273-05	PIN CONNECTOR 2P
P057	E40-0373-05	PIN CONNECTOR 3P
Q001	2SC3311(R)	TR. SI. NPN
Q002	2SC3311(R)	TR. SI. NPN
Q003	2SC3311(R)	TR. SI. NPN
Q004	2SA1323(B,C)	TR. SI. PNP
Q005	2SC3354(S,T)	TR. SI. NPN
Q006	2SC1973(T)	TR. SI. NPN
Q007	2SA1309(Q,R)	TR. SI. PNP
Q008	2SD438(F)	TR. SI. NPN
Q009	2SC3311(R)	TR. SI. NPN
Q010	2SC3311(R)	TR. SI. NPN
Q011	2SC3311(R)	TR. SI. NPN
Q012	2SC3311(R)	TR. SI. NPN
Q013	2SC3311(R)	TR. SI. NPN
Q014	2SC3311(R)	TR. SI. NPN
Q015	2SC3311(R)	TR. SI. NPN
Q016	2SC3311(R)	TR. SI. NPN
Q017	2SC3311(R)	TR. SI. NPN
Q018	UPA68H(L)	FET. N-CHANNEL DUAL
Q019	2SC3315(C,D)	TR. SI. NPN
Q020	2SA1309(Q,R)	TR. SI. PNP
Q021	UPA68H(L)	FET. N-CHANNEL DUAL
Q022	2SC3315(C,D)	TR. SI. NPN
Q023	2SC3311(R)	TR. SI. NPN
Q024	2SC3066	TR. SI. NPN-DUAL
Q025	NO USE	
Q026	2SC3311(R)	TR. SI. NPN
Q029	2SA1323(B,C)	TR. SI. PNP
Q030	2SA1323(B,C)	TR. SI. PNP
Q031	2SC3311(R)	TR. SI. NPN
Q034	2SA1323(B,C)	TR. SI. PNP
Q035	2SC3354(S,T)	TR. SI. NPN
Q036	2SC1973(T)	TR. SI. NPN
Q037	2SA1309(Q,R)	TR. SI. PNP
Q038	2SD438(F)	TR. SI. NPN
Q039	2SC3311(R)	TR. SI. NPN
Q040	2SC3311(R)	TR. SI. NPN
Q041	2SC3311(R)	TR. SI. NPN
Q042	NO USE	
Q043	2SC3311(R)	TR. SI. NPN
Q044	NO USE	
Q045	2SC3311(R)	TR. SI. NPN
Q046	NO USE	
Q047	2SC3311(R)	TR. SI. NPN
Q048	UPA68H(L)	FET. N-CHANNEL DUAL
Q049	2SC3315(C,D)	TR. SI. NPN
Q053	2SC3311(R)	TR. SI. NPN
Q054	2SC3311(R)	TR. SI. NPN
Q055	2SC3315(C,D)	TR. SI. NPN
Q056	2SC3315(C,D)	TR. SI. NPN
Q057	2SC3315(C,D)	TR. SI. NPN
Q058	2SC3315(C,D)	TR. SI. NPN
Q059	2SC3315(C,D)	TR. SI. NPN
Q060	2SC3315(C,D)	TR. SI. NPN
Q061	2SC3315(C,D)	TR. SI. NPN
Q062	2SA1239(F)	TR. SI. PNP-DUAL
Q063	NO USE	
Q064	2SC3315(C,D)	TR. SI. NPN
Q065	2SC3315(C,D)	TR. SI. NPN
Q066	2SC3315(C,D)	TR. SI. NPN
Q067	2SC3315(C,D)	TR. SI. NPN
Q068	2SC3311(R)	TR. SI. NPN
Q069	2SC3311(R)	TR. SI. NPN
Q070	2SC3315(C,D)	TR. SI. NPN
Q071	2SC3315(C,D)	TR. SI. NPN
Q072	2SA1323(B,C)	TR. SI. PNP
Q073	2SC3354(S,T)	TR. SI. NPN
Q074	2SA1323(B,C)	TR. SI. PNP
Q075	2SC3354(S,T)	TR. SI. NPN
Q076	2SA1309(Q,R)	TR. SI. PNP
Q077	2SA1323(B,C)	TR. SI. PNP
Q078	2SC3311(R)	TR. SI. NPN
Q079	2SA1309(Q,R)	TR. SI. PNP
Q080	2SA1309(Q,R)	TR. SI. PNP
Q081	2SA1309(Q,R)	TR. SI. PNP
Q082	2SA1309(Q,R)	TR. SI. PNP
Q083	2SA1323(B,C)	TR. SI. PNP

REF.NO	PARTS NO	NAME & DESCRIPTION			
R001	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R002	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R003	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R004	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R005	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R006	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R007	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R008	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R009	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R010	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R011	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R012	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R013	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R014	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R015	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R016	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R017	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R018	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R019	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R020	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R021	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R022	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R023	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R024	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R025	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R026	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R027	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R028	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R029	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R030	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R031	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R032	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R033	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R034	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R035	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R036	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R037	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R038	RN14BK2C2402F	RES. METAL FILM	24K	1%	1/6W
R039	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R040	RN14BK2C1202F	RES. METAL FILM	12K	1%	1/6W
R041	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R042	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R043	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R044	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R045	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R046	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R047	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R048	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R049	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R050	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R051	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R052	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R053	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R054	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R055	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R056	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R057	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R058	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R059	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R060	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R061	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R062	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R063	NO USE				
R064	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R065	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R066	NO USE				
R067	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R068	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R069	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R070	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R071	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R072	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R073	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R074	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R075	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R076	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R077	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R078	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R079	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R080	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R081	NO USE				
R082	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R083	RD14BB2C393J	RES. CARBON	39K	5%	1/6W
R084	RD14BB2C273J	RES. CARBON	27K	5%	1/6W
R085	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R086	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R087	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R088	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R089	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R090	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R091	RN14BK2C5100F	RES. METAL FILM	510	1%	1/6W
R092	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R093	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R094	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R095	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R096	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R097	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R098	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R099	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R100	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R105	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R110	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R111	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R112	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R113	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R114	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R115	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R116	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R117	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R118	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R124	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R136	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R137	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R138	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R139	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R140	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R141	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R142	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R143	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R144	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R145	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R146	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R147	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R148	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R149	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R150	RN14BK2C7501F	RES. METAL FILM	7.5K	1%	1/6W
R151	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R152	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R153	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R154	RN14BK2C2402F	RES. METAL FILM	24K	1%	1/6W
R155	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R156	RN14BK2C1202F	RES. METAL FILM	12K	1%	1/6W
R157	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R158	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R159	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R160	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R161	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R162	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R163	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R164	NO USE				
R165	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R166	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R167	NO USE				
R168	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R169	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R170	NO USE				
R171	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R172	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R173	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R174	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R175	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R176	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R177	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R178	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R179	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R180	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R190	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R191	NO USE				
R192	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R193	NO USE				
R194	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R195	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R196	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R197	RD14BB2C751J	RES. CARBON	750	5%	1/6W
R198	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R199	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R200	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R201	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R202	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R203	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R204	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W

REF.NO	PARTS NO	NAME & DESCRIPTION			
R205	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R206	RN14BK2C3301F	RES. METAL FILM	3.3K	1%	1/6W
R207	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R208	RN14BK2C3301F	RES. METAL FILM	3.3K	1%	1/6W
R209	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R210	RD14BB2C392J	RES. CARBON	3.9K	5%	1/6W
R211	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R212	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R213	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R214	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R215	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R216	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R217	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R218	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R219	RN14BK2C3301F	RES. METAL FILM	3.3K	1%	1/6W
R220	RN14BK2C6201F	RES. METAL FILM	6.2K	1%	1/6W
R221	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R222	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R223	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R224	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R225	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R226	RD14BB2C621J	RES. CARBON	620	5%	1/6W
R227	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R228	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R229	RN14BK2C1601F	RES. METAL FILM	1.6K	1%	1/6W
R230	RN14BK2C1601F	RES. METAL FILM	1.6K	1%	1/6W
R231	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R232	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R233	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R234	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R235	RN14BK2C1500F	RES. METAL FILM	150	1%	1/6W
R236	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R237	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R238	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R239	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R240	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R241	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R242	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R243	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R244	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R245	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R246	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R247	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R248	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R249	RD14BB2C911J	RES. CARBON	910	5%	1/6W
R250	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R251	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R252	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R253	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R254	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R255	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R256	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R257	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R258	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R259	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R260	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R261	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R262	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R263	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R264	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R265	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R266	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R267	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R268	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R269	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R270	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R271	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R272	NO USE				
R273	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R274	NO USE				
R275	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R276	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R277	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R278	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R279	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R280	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R281	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R282	NO USE				
R283	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R284	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R285	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R286	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R287	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R288	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R289	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R290	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R291	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R292	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R293	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R294	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R295	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R296	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R297	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R298	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R299	RD14BB2C2R7J	RES. CARBON	2.7	5%	1/6W
R300	NO USE				
R301	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R302	RN14BK2C9102F	RES. METAL FILM	91K	1%	1/6W
R303	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R304	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R305	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R306	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R307	RN14BK2C8201F	RES. METAL FILM	8.2K	1%	1/6W
R308	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R309	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R313	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R314	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R315	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R316	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R317	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R318	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R319	RD14BB2C820J	RES. CARBON	82	5%	1/6W
R320	RD14BB2C301J	RES. CARBON	300	5%	1/6W
R325	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R326	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R327	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R330	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R331	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R332	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R333	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R334	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R335	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R336	RD14BB2C561J	RES. CARBON	560	5%	1/6W
TC001	C05-0309-05	CAP. TRIMMER	40P		
TC002	C05-0309-05	CAP. TRIMMER	40P		
TC003	C05-0031-15	CAP. TRIMMER	10P		
TC004	C05-0031-15	CAP. TRIMMER	10P		
TC005	C05-0031-15	CAP. TRIMMER	10P		
TC006	C05-0031-15	CAP. TRIMMER	10P		
VR001	R12-2512-05	RES. SEMI FIXED	5KB		
VR002	R12-1518-05	RES. SEMI FIXED	2KB		
VR003	R12-2512-05	RES. SEMI FIXED	5KB		
VR004	R12-1518-05	RES. SEMI FIXED	2KB		
VR005	R12-0539-05	RES. SEMI FIXED	200B		
VR006	R12-1517-05	RES. SEMI FIXED	1KB		
VR007	R12-1517-05	RES. SEMI FIXED	1KB		
VR008	R12-1517-05	RES. SEMI FIXED	1KB		
VR009	R12-2512-05	RES. SEMI FIXED	5KB		
VR010	R12-2512-05	RES. SEMI FIXED	5KB		
VR011	R12-1518-05	RES. SEMI FIXED	2KB		
VR012	R12-1518-05	RES. SEMI FIXED	2KB		
VR013	R12-0421-05	RES. SEMI FIXED	100B		
VR014	R12-0540-05	RES. SEMI FIXED	500B		
VR015	R12-1518-05	RES. SEMI FIXED	2KB		
VR016	R12-5516-05	RES. SEMI FIXED	100KB		
VR017	R12-1518-05	RES. SEMI FIXED	2KB		

HORIZONTAL OUTPUT AMP UNIT

X74-1360-02

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E23-0512-05	TERMINAL			
	F01-0849-05	HEAT SINK			
	J25-5039-52	PCB (UNMOUNTED)			
	N30-3006-41	SCREW, PAN HD	M3X6		
C001	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C002	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C003	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C004	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C005	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C006	CC45CH2H010C	CAP. CERAMIC	1P	0.25P	500V
C007	CC45CH2H010C	CAP. CERAMIC	1P	0.25P	500V
C008	CC45CH2H030C	CAP. CERAMIC	3P	0.25P	500V
C009	CC45CH2H010C	CAP. CERAMIC	1P	0.25P	500V
C010	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C011	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C012	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C013	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C014	C91-0549-05	CAP. TANTALUM	1	20%	35V
C015	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C016	C91-0549-05	CAP. TANTALUM	1	20%	35V
C017	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C018	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C019	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C020	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C021	CE04EW2A100M	CAP. ELECTRO	10	20%	100V
C022	CE04W2C2R2M	CAP. ELECTRO	2.2	20%	160V
C023	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
D001	1SS132	DIODE			
D002	MTZ5.1JB	DIODE, ZENER	5.0V		
D003	1SS132	DIODE			
D004	1SS132	DIODE			
L001	L40-1011-04	FERRI INDUCTOR	100UH (7H)		
L002	L40-1011-04	FERRI INDUCTOR	100UH (7H)		
L003	L40-1011-04	FERRI INDUCTOR	100UH (7H)		
L004	L40-1011-04	FERRI INDUCTOR	100UH (7H)		
P027	E40-0873-05	PIN CONNECTOR	8P		
P035	E40-0473-05	PIN CONNECTOR	4P		
P036	E40-0673-05	PIN CONNECTOR	6P		
Q001	2SA1323(B,C)	TR. SI, PNP			
Q002	2SA1323(B,C)	TR. SI, PNP			
Q003	2SA1323(B,C)	TR. SI, PNP			
Q004	2SC3311(R)	TR. SI, NPN			
Q005	2SC2912(S)	TR. SI, NPN			
Q006	2SC2912(S)	TR. SI, NPN			
Q007	2SA1210(S)	TR. SI, PNP			
Q008	2SA1210(S)	TR. SI, PNP			
Q009	2SC3311(R)	TR. SI, NPN			
Q010	2SC3311(R)	TR. SI, NPN			
R001	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R002	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R003	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R004	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R005	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R006	RD14BY2H473J	RES. CARBON	47K	5%	1/2W
R007	RD14BY2H473J	RES. CARBON	47K	5%	1/2W
R008	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R009	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R010	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R011	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R012	RS14GB3A223J	RES. METAL FILM	22K	5%	1W
R013	RS14GB3A223J	RES. METAL FILM	22K	5%	1W
R014	RD14BB2C134J	RES. CARBON	130K	5%	1/6W
R015	RD14BB2C134J	RES. CARBON	130K	5%	1/6W
R016	RD14BY2H123J	RES. CARBON	12K	5%	1/2W
R017	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R018	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R019	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R020	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R021	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R022	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R023	NO USE				
R024	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R025	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R026	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R027	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W

VERTICAL ATTENUATOR UNIT

X75-1170-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5215-04	PCB (UNMOUNTED)			
	R92-0150-05	JUMPING RES.	ZERO OHM		
	R92-1061-05	JUMPING RES.	ZERO OHM		
	S02-4508-05	ATTENUATOR UNIT			
	002-0001-05	BRAIDED WIRE			
	212-2014-05	TUBE (PLASTIC)			
	212-3017-05	TUBE (PLASTIC)			
C001	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C002	CC45CH1H470J	CAP. CERAMIC	47P	5%	50V
C003	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C004	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C011	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C012	CC45CH1H470J	CAP. CERAMIC	47P	5%	50V
C013	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C014	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
J003	E31-2906-05	WIRE ASS'Y (CH2 VARI)			
J004	E31-2905-05	WIRE ASS'Y (CH1 VARI)			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
L001	L40-2282-70	FERRI INDUCTOR	0.22UH		
L011	L40-2282-70	FERRI INDUCTOR	0.22UH		
P007	E40-0273-05	PIN CONNECTOR	2P		
P008	E40-0273-05	PIN CONNECTOR	2P		
R001	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R002	RN14BK2C1000D	RES. METAL FILM	100	0.5%	1/6W
R003	RN14BK2C1000D	RES. METAL FILM	100	0.5%	1/6W
R004	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R005	RN14BK2C1000D	RES. METAL FILM	100	0.5%	1/6W
R006	RN14BK2C1000D	RES. METAL FILM	100	0.5%	1/6W
R007	RD14BB2C390J	RES. CARBON	39	5%	1/6W
R008	RD14BB2C150J	RES. CARBON	15	5%	1/6W
R009	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R010	NO USE				
R011	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R012	RN14BK2C1000D	RES. METAL FILM	100	0.5%	1/6W
R013	RN14BK2C1000D	RES. METAL FILM	100	0.5%	1/6W
R014	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R015	RN14BK2C1000D	RES. METAL FILM	100	0.5%	1/6W
R016	RN14BK2C1000D	RES. METAL FILM	100	0.5%	1/6W
R017	RD14BB2C390J	RES. CARBON	39	5%	1/6W
R018	RD14BB2C150J	RES. CARBON	15	5%	1/6W
R019	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R020	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R021	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R022	RD14BB2C330J	RES. CARBON	33	5%	1/6W
R023	RD14BB2C330J	RES. CARBON	33	5%	1/6W

A TRIG SWITCH UNIT

X77-1280-02

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J23-5039-52	PCB (UNMOUNTED)			
	L92-0110-05	FERRITE BEADS			
	212-2014-05	TUBE (PLASTIC)			
C001	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C002	CC45CH1H680J	CAP. CERAMIC	68P	5%	50V
C003	CC45CH1H680J	CAP. CERAMIC	68P	5%	50V
C006	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C007	CC45CH1H070D	CAP. CERAMIC	7P	0.5P	50V
C008	CC45CH1H070D	CAP. CERAMIC	7P	0.5P	50V
C009	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C010	NO USE				
C011	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C012	NO USE				
C013	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C014	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C015	CE04BW1H010M	CAP. ELECTRO	1	20%	50V
C016	NO USE				
C017	CE04BW1H010M	CAP. ELECTRO	1	20%	50V
C018	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C019	CE04EW1H010M	CAP. ELECTRO	1	20%	50V
C020	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C021	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C022	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C023	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C024	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C025	NO USE				
C026	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C027	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C028	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C029	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C030	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C031	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C032	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C033	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C034	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C035	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C036	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C037	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C038	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C042	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C043	NO USE				
C044	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C045	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C046	NO USE				
C047	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C048	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C049	CE04EW1H3R3M	CAP. ELECTRO	3.3	20%	50V
C050	NO USE				
C051	CK45B2H102K	CAP. CERAMIC	1000P	10%	500V

REF.NO	PARTS NO	NAME & DESCRIPTION			
D001	SV03YS	DIODE, SILICON VARISTOR			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	MTZ16JA	DIODE, ZENER	15V		
D005	1SS132	DIODE			
D006	1SS132	DIODE			
D007	1SS132	DIODE			
D008	1SS132	DIODE			
D009	SV04YS	DIODE, SILICON VARISTOR			
D010	NO USE				
D011	1SS135	DIODE			
D012	1SS135	DIODE			
L001	L40-1011-03	FERRI INDUCTOR	100UH (5H)		
L002	L40-1011-03	FERRI INDUCTOR	100UH (5H)		
P024	E40-0273-05	PIN CONNECTOR	2P		
P043	E40-0273-05	PIN CONNECTOR	2P		
P046	E40-0273-05	PIN CONNECTOR	2P		
P047	E40-0573-05	PIN CONNECTOR	5P		
P059	E40-0973-05	PIN CONNECTOR	9P		
Q003	DN1901	FET, DUAL, N-CHANNEL			
Q004	2SC3354(S,T)	TR. SI, NPN			
Q005	2SC3354(S,T)	TR. SI, NPN			
Q006	2SA1161	TR. SI, PNP			
Q007	2SA1161	TR. SI, PNP			
Q008	2SA1309(Q,R)	TR. SI, PNP			
Q009	2SC3066	TR. SI, NPN-DUAL			
Q010	2SC2671(H)	TR. SI, NPN			
Q011	2SC2671(H)	TR. SI, NPN			
Q012	2SC3354(S,T)	TR. SI, NPN			
Q013	2SC3354(S,T)	TR. SI, NPN			
Q014	2SC3354(S,T)	TR. SI, NPN			
Q015	2SC3354(S,T)	TR. SI, NPN			
Q016	2SC2671(H)	TR. SI, NPN			
Q017	2SK241(Y)	FET, N-CHANNEL, MOS			
Q018	2SA1309(Q,R)	TR. SI, PNP			
Q019	2SK30A(D)	FET, N-CHANNEL			
Q020	2SC3311(R)	TR. SI, NPN			
Q021	2SA1309(Q,R)	TR. SI, PNP			
Q022	2SC3311(R)	TR. SI, NPN			
Q023	2SA1309(Q,R)	TR. SI, PNP			
Q024	2SK30A(D)	FET, N-CHANNEL			
Q025	2SA1309(Q,R)	TR. SI, PNP			
R001	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R002	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R003	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R006	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R007	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R011	RD14BB2C821J	RES. CARBON	820	5%	1/6W
R012	NO USE				
R013	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R014	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R015	RD14BB2C431J	RES. CARBON	430	5%	1/6W
R016	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R017	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R018	NO USE				
R019	RD14BB2C754J	RES. CARBON	750K	5%	1/6W
R020	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R021	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R022	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R023	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R024	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R025	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R026	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R027	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R028	RN14BK2C2200F	RES. METAL FILM	220	1%	1/6W
R029	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R030	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R031	RN14BK2C1501F	RES. METAL FILM	1.5K	1%	1/6W
R032	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R033	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R034	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R035	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R036	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R037	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R038	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R039	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R040	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R041	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R042	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R043	RD14BB2C161J	RES. CARBON	160	5%	1/6W
R044	RD14BB2C131J	RES. CARBON	130	5%	1/6W
R045	RD14BB2C131J	RES. CARBON	130	5%	1/6W
R046	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R047	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R048	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R049	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R050	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R051	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R052	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R053	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R054	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R055	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R056	RD14BB2C752J	RES. CARBON	7.5K	5%	1/6W
R057	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R058	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R059	RD14BB2C202J	RES. CARBON	2K	5%	1/6W
R060	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R061	RD14BB2C123J	RES. CARBON	12K	5%	1/6W
R062	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R063	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R064	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R065	RD14BB2C683J	RES. CARBON	68K	5%	1/6W
R066	RD14BB2C914J	RES. CARBON	910K	5%	1/6W
R067	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R068	RD14BB2C163J	RES. CARBON	16K	5%	1/6W
R069	RD14BB2C163J	RES. CARBON	16K	5%	1/6W
R070	RD14BB2C912J	RES. CARBON	9.1K	5%	1/6W
R071	RD14BB2C163J	RES. CARBON	16K	5%	1/6W
R072	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R073	RD14BB2C912J	RES. CARBON	9.1K	5%	1/6W
R074	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R075	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R076	RD14BB2C333J	RES. CARBON	33K	5%	1/6W
R077	RD14BB2C333J	RES. CARBON	33K	5%	1/6W
R078	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R079	RD14BB2E274J	RES. CARBON	270K	5%	1/4W
R080	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R081	RD14BB2C754J	RES. CARBON	750K	5%	1/6W
S001	S33-2504-05	LEVER SWITCH 2-6			
S002	S32-4008-05	LEVER SWITCH 4-5			
S003	R01-5506-05	V.R. SWITCH	100KB		
S004	R01-5506-05	V.R. SWITCH	100KB		
TC001	C05-0412-05	CAP. TRIMMER	20P		
VR001	R01-5506-05	V.R. SWITCH	100KB		
VR002	R12-3522-05	RES. SEMI FIXED	10KB		
VR003	NO USE				
VR004	R12-1520-05	RES. SEMI FIXED	2KB		

VERTICAL MODE SWITCH UNIT

X77-1310-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5051-23	PCB (UNMOUNTED)			
C001	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C002	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C003	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
P001	E40-0473-05	PIN CONNECTOR	4P		
P002	E40-1273-05	PIN CONNECTOR	12P		
P007	E40-0373-05	PIN CONNECTOR	3P		
P008	E40-0373-05	PIN CONNECTOR	3P		
R001	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R002	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R003	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R004	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
S001	S33-2501-05	LEVER SWITCH 2-5			
S002	S42-2512-05	PUSH SWITCH 2-2 X2			
S003	S42-2512-05	PUSH SWITCH 2-2 X2			
VR001	R05-1504-05	V.R.	1KB		
VR002	R05-1504-05	V.R.	1KB		

HORIZONTAL MODE SWITCH UNIT

X77-1320-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E31-0762-05	UNIVERSAL LED SOCKET			
	E31-2510-05	UNIVERSAL LED SOCKET			
	J25-5051-23	PCB (UNMOUNTED)			
	R92-0150-05	JUMPING RES.	ZERO OHM		
C001	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C002	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
P048	E40-1811-05	PIN CONNECTOR	18P		
P063	E40-0373-05	PIN CONNECTOR	3P		
R001	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R002	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R003	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R004	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R005	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R006	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R007	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R008	RD14BB2C331J	RES. CARBON	330	5%	1/6W
S001	S33-2505-05	LEVER SWITCH 2-5			
S002	S33-2501-05	LEVER SWITCH 2-5			
VR001	R12-5520-05	RES. SEMI FIXED	150KB		

PARTS LIST

SWITCHING POWER SUPPLY

W02-0413-05

REF. NO	PARTS NO	NAME & DESCRIPTION		
D1	DBA20G	Diode		
D2	DFA01	Diode		
D3	DTA-10ER	Triac		
D4	DS442X	Diode		
D5	GFD10E	Diode		
D6	GFD10E	Diode		
D7	GFD10G	Diode		
D8	HZ3.6CP	Diode Zener		
D9	GZA6.2Z	Diode Zener		
Q1	2SC536KNP(F)	Transistor		
IC1	STK7308	IC		
IC2	STK732	IC		
L1	L19-0415-08	Line filter		
L2	L19-0414-08	Pulse Transformer		
L3	L33-0809-08	Coil	20μH	
L4	L33-0810-08	Coil	2.3μH	
L5	L33-0809-08	Coil	20μH	
L6	L40-4791-14	Ferri-inductor	4.7μH	
L7	L40-4791-14	Ferri-inductor	4.7μH	
L8	L40-4791-14	Ferri-inductor	4.7μH	
C1	C91-0599-08	Polyester cap	0.22μF	400V
C2	C91-0597-08	Ceramic cap	2200pF	250V
C3	C91-0597-08	Ceramic cap	2200pF	250V
C4	C91-0597-08	Ceramic cap	2200pF	250V
C5	C91-0597-08	Ceramic cap	2200pF	250V
C6	C90-0925-08	Electrolytic cap	100μF	400V
C7	C90-0926-08	Electrolytic cap	4.7μF	50V
C8	C90-0927-08	Electrolytic cap	10μF	50V
C9	C90-0928-08	Electrolytic cap	47μF	25V
C10	CK45B1H103K	Ceramic cap	0.01μF	50V
C11	C91-0598-08	Ceramic cap	0.001μF	1kV
C12	C90-0929-08	Electrolytic cap	470μF	16V
C13	C90-0930-08	Electrolytic cap	1000μF	10V
C14	C90-0929-08	Electrolytic cap	470μF	16V
C15	C90-0931-08	Electrolytic cap	220μF	35V
C16	C90-0932-08	Electrolytic cap	100μF	63V
C17	C90-0933-08	Electrolytic cap	22μF	160V
C18	C90-0934-08	Electrolytic cap	220μF	16V
C19	C90-0931-08	Electrolytic cap	220μF	35V
C20	C90-0935-08	Electrolytic cap	22μF	50V
C21	C90-0936-08	Electrolytic cap	10μF	100V
C22	C90-0933-08	Electrolytic cap	22μF	160V
C23	C91-0600-08	Ceramic cap	0.01μF	630V
C24	C91-0598-08	Ceramic cap	0.001μF	1kV
C25	C91-0598-08	Ceramic cap	0.001μF	1kV
C26	C90-0937-08	Electrolytic cap	22μF	16V
R1	R92-1111-08	Widing res	10Ω	3W
R2	R92-1112-08	Widing res	2Ω	3W
R3	RD14BB2E910J	Carbon res	91Ω ±5%	1/4W
R4	R92-1113-08	Metal oxide res	220kΩ	1W
R5	RD14BB2E562J	Carbon res	5.6kΩ ±5%	1/4W
R6	RD14BB2E103J	Carbon res	10kΩ ±5%	1/4W
R7	R92-1114-08	Metal oxide res	33Ω	1W
R8	RD14BB2E102J	Carbon res	1kΩ ±5%	1/4W
R9	RD14BB2E100J	Carbon res	10Ω ±5%	1/4W
R12	RN14BK2E2201F	Metal film	2.2kΩ ±1%	1/4W
VR1	R12-3532-08	Semi-fixed res	10kΩ	
	E40-7011-08	Pin connector	3P	
	E40-7012-08	Pin connector	7P	
	F20-0643-08	Insulating sheet	(STK7308)	
	F20-0644-08	Insulating sheet	(STK732)	

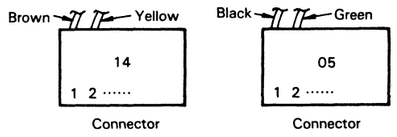
PARTS LIST

The specifications and parts list and schematic diagram may be changed without notice owing to a technical innovation.

The part No. of each connector is stamped or color-coded. The color-coding is as follows.

Black	Brown	Red	Orange	Yellow	Green	Blue	Purple	Grey	White
0	1	2	3	4	5	6	7	8	9

Example



Each connector can be classified by the color of pin 1 and pin 2.

PARTS LIST

CS-1100A UNIT

Y70-1610-61

REF.NO	PARTS NO	NAME & DESCRIPTION
1	A01-1119-02	CASE (TOP)
2	A01-1120-12	CASE (BOTTOM)
3	A13-0779-12	FRAME (R)
4	A13-0780-02	FRAME (L)
5	A20-2764-11	MOLDED PANEL
6	A21-1059-32	DECORATIVE PANEL
7	A22-0839-22	SUB PANEL
8	A23-1651-22	REAR PANEL
9	B07-0703-04	ESCUTCHEON FOR ASTIG
10	B07-0712-13	FILTER FRAME
11	B19-0726-04	FILTER
12	B20-0929-04	SCALE
13	B30-0945-05	SCALE ILLUMI LAMP ASS'Y
14	B40-2765-04	NAME PLATE (SERIAL NO)
	B41-0710-04	CAUTION LABEL (HIGH VOLTAGE)
	B41-0764-23	CAUTION LABEL (REAR PANEL)
	B50-7644-10	INSTRUCTION MANUAL
15	E01-1403-05	CRT SOCKET
16	E04-0259-05	BNC RECEPTACLE
17	E21-0657-04	TERMINAL (GND)
18	E21-0660-04	TERMINAL (CAL)
	E23-0043-04	EARTH LUG (FUSE HOLDER)
	E23-0513-05	EARTH LUG (BNC)
	E23-0522-14	EARTH LUG (CRT EARTH)
	E23-0528-04	EARTH PLATE (FRAME-CASE)
	E23-0531-04	EARTH PLATE
	E23-0532-04	EARTH PLATE
	E30-1818-05	JIS POWER CORD
	E30-1819-05	CEE POWER CORD
	E30-1820-05	UL/CSA POWER CORD
	E30-1821-05	SAA POWER CORD
	E31-0564-05	WIRE ASS'Y
	E31-2473-05	WIRE ASS'Y (AC,GND)
	E31-2488-35	LEAD WIRE WITH HARNESSES
	E31-2502-05	WIRE ASS'Y (V.FINAL)
	E31-2503-05	WIRE ASS'Y (H.FINAL)
19A	F05-1222-05	FUSE 1.25AT (5X20MM) N.EUROPE
19B	F05-1224-05	FUSE 1.2A (6X30MM)
20	F07-0908-14	PROTECTION COVER (HANDLE)
21	F10-1567-14	EARTH BAND (FOR H.V.BLOCK)
22	F10-1568-04	SHIELD PLATE (FOR SW P.S.)
23	F11-0985-04	SHIELD CASE (H) FOR H.V.BLOCK
24	F11-0990-13	CRT SHIELD
25	F15-0733-04	FELT (CRT SHIELD)
26	F20-0624-04	INSULATOR (FOR BLANKING)
27	G02-0606-14	SPRING FOR HANDLE
28	G02-0607-04	SPRING FOR CRT
29	G16-0611-04	REFLECTOR SHEET (L)
30	G16-0612-04	REFLECTOR SHEET (R)
	H01-5725-24	CARTON BOX
	H10-2817-11	FOAMED STYRENE PAD (FRONT)
	H10-2818-11	FOAMED STYRENE PAD (REAR)
	H20-1727-04	VINYL COVER
31	J02-0089-05	RUBBER LEG
32	J10-0100-22	BEZEL
33A	J13-0031-05	FUSE HOLDER (NORTH EUROPE)
33B	J13-0033-15	FUSE HOLDER
34	J19-1620-05	CORD KEEP
35	J19-1635-04	HOLDER FOR LED
36	J21-2906-05	GEAR FOR HANDLE
37	J21-2907-05	RING FOR HANDLE
38	J21-2970-23	BLACKET FOR CRT
39	J21-2979-14	BLACKET FOR SCALE
40	J21-4511-04	BLACKET FOR CRT SHIELD
41	J31-0603-04	COLLAR (TRACE ROTATION)
42	J39-0522-04	SPACER FOR V.R.
43	J42-0515-05	BUSHING
44	J42-0522-04	BUSHING (FREE)
45	J42-0523-04	BUSHING A (CRT)
	J59-0403-05	NYLON RIVET (ILLUMI)
	J61-0049-05	WIRE BAND
46	J61-0511-05	SADDLE FOR WIRE (WS-2NA)
47	K01-0520-15	HANDLE
48	K21-0868-03	KNOB (ATT)
49	K21-0869-04	KNOB (VARI)
50	K21-0870-04	KNOB (FOR SINGLE V.R.)
51	K21-0871-04	KNOB (FOR INSIDE V.R.)
52	K21-0872-04	KNOB (FOR OUTSIDE V.R.)
53	K21-0873-04	KNOB (A SWEEP)
54	K21-0874-03	KNOB (B SWEEP)
55	K27-0528-14	KNOB (FOR PUSH SW)
56	K27-0530-14	KNOB (FOR LEVER SW)
	N08-0611-04	SCREW (FOR CORD WRAP)
	N09-0402-05	SCREW (FOR PULLEY)

REF.NO	PARTS NO	NAME & DESCRIPTION
	N09-0705-05	SCREW, HEX SOCKET FLAT HD M4X8
	N09-0709-05	SCREW, WITH WASHER
	N09-0715-04	SCREW, PAN HD M4X31
	N09-0757-05	SCREW, SEMS TAP TITE M3X6
	N10-2030-41	NUT, HEX
	N10-2070-41	NUT, HEX
	N15-1110-41	WASHER
	N17-1030-41	LOCK WASHER M3
	N19-0704-04	WASHER (FOR SW KNOB)
	N19-0710-05	WASHER
	N30-3006-41	SCREW, PAN HD M3X6
	N30-3008-41	SCREW, PAN HD M3X8
	N30-3010-41	SCREW, PAN HD M3X10
	N32-3006-41	SCREW, FLAT HD M3X6
	N32-3008-41	SCREW, FLAT HD M3X8
	N34-3012-41	SCREW, TRUSS M3X12
	N88-3006-41	SCREW, FLAT HD TAP TITE
	N89-3006-41	SCREW, BINDING TAP TITE
	N89-3010-41	SCREW, BINDING TAP TITE
	R92-0150-05	JUMPING RES. ZERO OHM
57	W01-0503-04	CORD WRAP
58	W02-0413-05	SWITCHING POWER SUPPLY
59	W02-0418-05	HIGH VOLTAGE POWER BLOCK
60	X68-1400-03	POWER BLANKING UNIT
61	X70-1020-00	FILTER UNIT
62	X73-1500-04	VERTICAL PREAMP UNIT
63	X73-1510-04	VERTICAL OUTPUT AMP UNIT
64	X74-1310-03	SWEEP ROTARY UNIT
65	X74-1350-02	TRIG SWEEP UNIT
66	X74-1360-02	HORIZONTAL OUTPUT AMP UNIT
67	X75-1170-00	VERTICAL ATTENUATOR UNIT
68	X77-1280-02	A TRIG SWITCH UNIT
69	X77-1310-00	VERTICAL MODE SWITCH UNIT
70	X77-1320-00	HORIZONTAL MODE SWITCH UNIT
	002-0001-05	BRAIDED WIRE
71	150WTM31	CRT
	212-2014-05	TUBE (PLASTIC)
	490-0007-05	TAPE
	490-0012-05	TAPE
C001	C91-0501-05	CAP. METAL FILM 0.047 10% 630V
C002	C91-0501-05	CAP. METAL FILM 0.047 10% 630V
D001	PG4133SX	LED (GREEN) TRIG
D002	AR4133S	LED (RED) POWER,RESET
D008	AR4133S	LED (RED) POWER,RESET
J001	E31-2492-05	WIRE ASS'Y (CH2 INV)
J002	E31-2493-05	WIRE ASS'Y (V.MODE)
J007	E31-2907-05	WIRE ASS'Y (CH1 POSI.X5 GAIN)
J008	E31-2908-05	WIRE ASS'Y (CH2 POSI.X5 GAIN)
J030	E31-2497-05	WIRE ASS'Y (DC INPUT)
J031	E31-2498-05	WIRE ASS'Y (AC INPUT)
J032	E31-2499-15	WIRE ASS'Y (P2.G2.ISD)
J033	E31-2500-05	WIRE ASS'Y (P1.K.G1)
J048	E31-2501-05	WIRE ASS'Y (H.MODE)
72 L001	L39-0520-05	ROTATION COIL
73 L002	L76-0108-25	DELAY LINE
L003	L40-2282-13	AXIAL COIL 0.22UH
L004	L40-2282-13	AXIAL COIL 0.22UH
R001	RD14BB2E105J	RES. CARBON 1M 5% 1/4W
R002	RD14BB2E105J	RES. CARBON 1M 5% 1/4W
R003	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R004	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R009	RD14BB2E471J	RES. CARBON 470 5% 1/4W
R010	RD14BB2E471J	RES. CARBON 470 5% 1/4W
R014	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
74 S023	S33-1501-05	LEVER SWITCH (AC-GND-DC)
74 S024	S33-1501-05	LEVER SWITCH (AC-GND-DC)
75 S025	R23-2501-05	V.R. (HOLD OFF) 5KBX2
76 S026	R06-2502-05	V.R. (H.POSI) 5KBX2
77 VR007	R29-0504-25	V.R. (D.T.M.) 1KB
78 VR008	R05-3505-05	V.R. (ROTATION) 20KB
75 VR05A	R23-2501-05	V.R. (HOLD OFF) 5KBX2
75 VR05B	R23-2501-05	V.R. (HOLD OFF) 5KBX2
76 VR06A	R06-2502-05	V.R. (H.POSI) 5KBX2
76 VR06B	R06-2502-05	V.R. (H.POSI) 5KBX2
79 VR11A	R23-1502-05	V.R. (INTEN) 1KBX2
79 VR11B	R23-1502-05	V.R. (INTEN) 1KBX2

VOLTMETER AND WAVEFORMS

The voltages and waveforms are measured on each schematic diagram as follows;

TEST EQUIPMENT

Digital multimeter : DL-720 (TRIO)
Oscilloscope : 475A (TEKTRONIX)
Sine wave generator : SG-502 (TEKTRONIX)

CONTROL SETTINGS

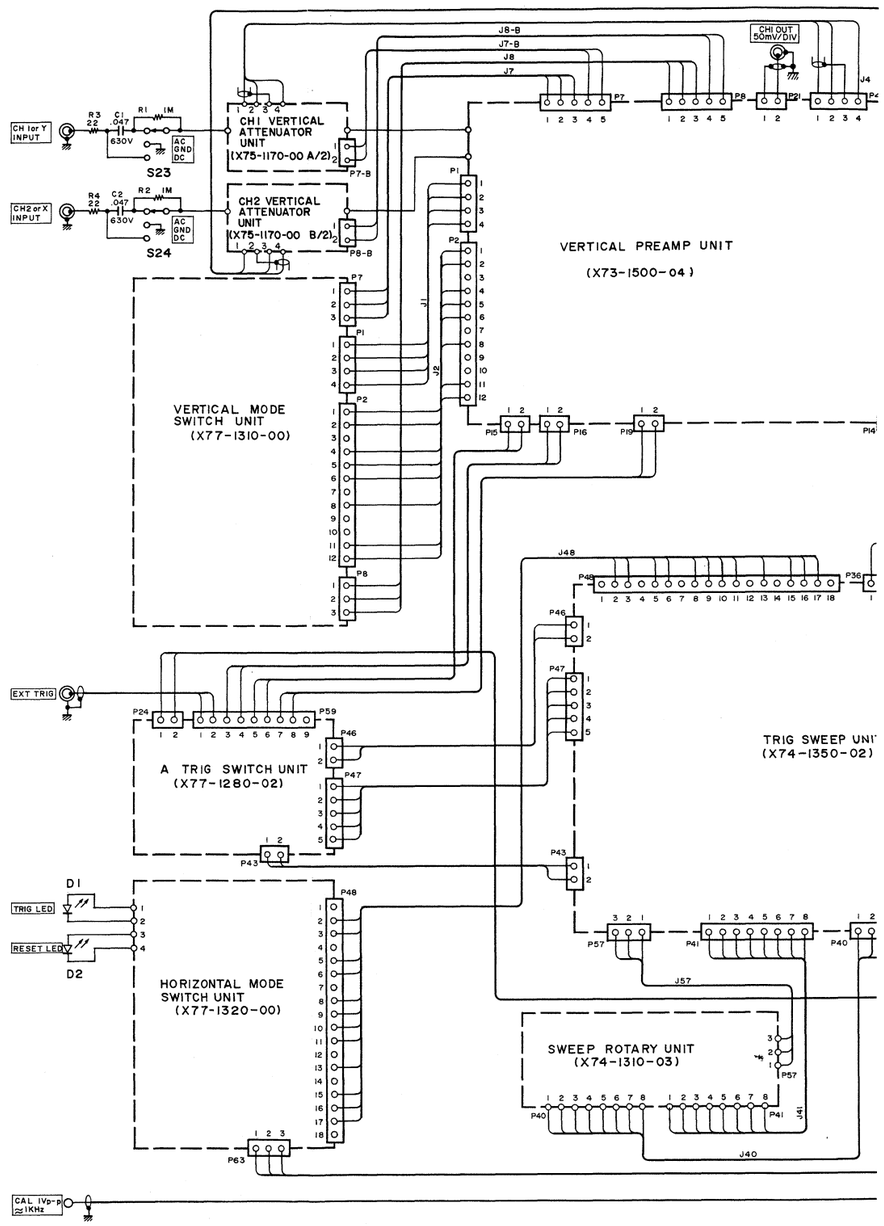
A INTENSITY	Midrange
FOCUS	Midrange
AC-GND-DC	GND for voltage measurement DC for waveform measurement
▲▼ POSITION	Midrange
CH1, CH2 VARIABLE	CAL
CH1, CH2 VOLTS/DIV	0.2 V
CH2 INV	OFF
V. MODE	Unless otherwise specified CH1
20 MHz BW	OFF
COUPLING	AC
SLOPE	+
TRIG. MODE	AUTO
HOLDOFF	NORM
A SWEEP TIME/DIV	0.2 ms
B SWEEP TIME/DIV	50 μs
A. VARIABLE	CAL
◄► POSITION	Midrange
HORIZ DISPLAY	A
X10 MAG	OFF

Voltage Measurements

Voltage measurements are taken with no signal applied and the trace positioned to the center horizontal graticule line. The digital multimeter common should be connected to chassis ground at the nearest measurement point.

Waveform Condition

Waveforms are measured with 1 kHz 1 Vp-p sine wave applied CH1 input.



signal applied and
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be connected to
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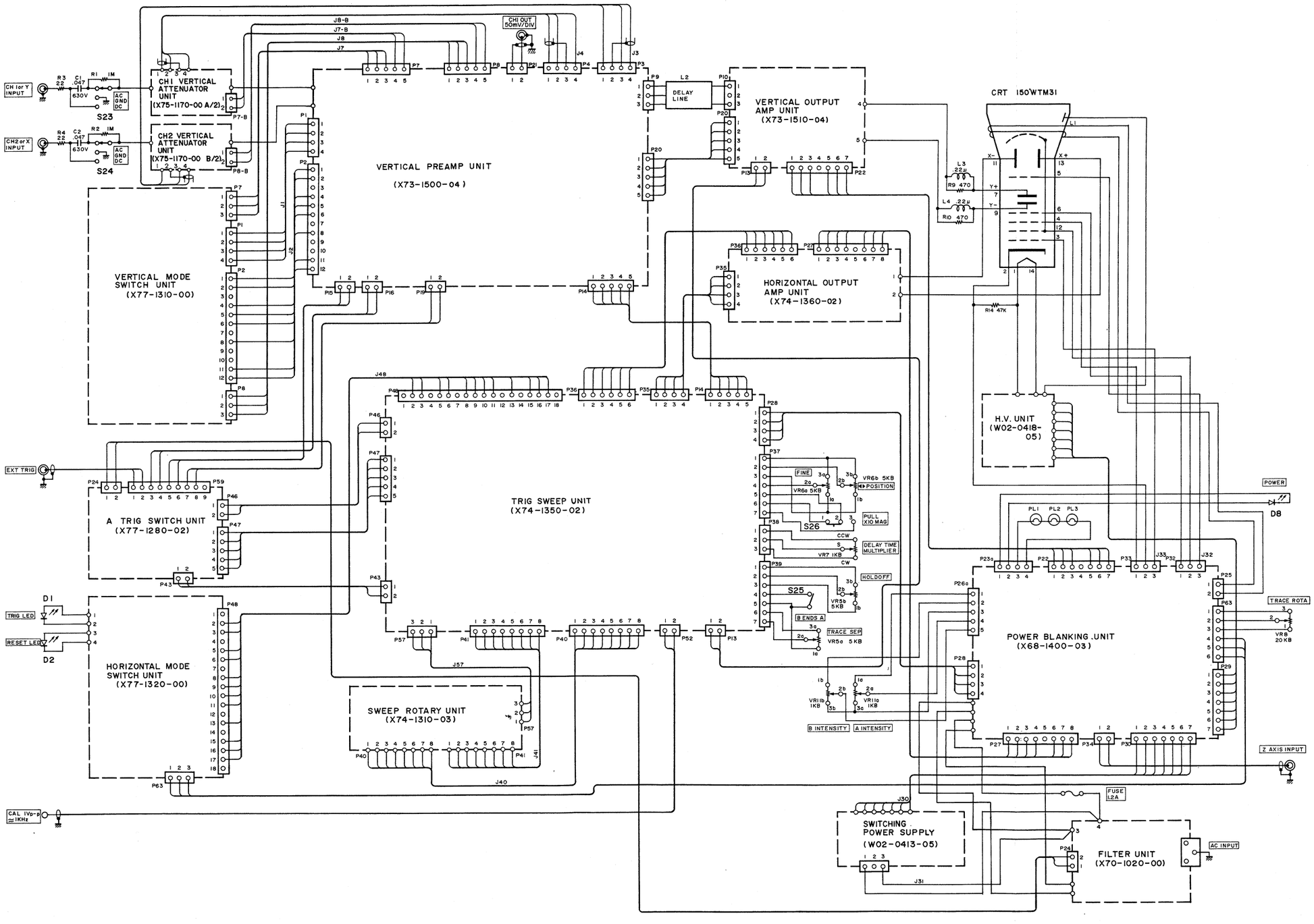
p-p sine wave ap-

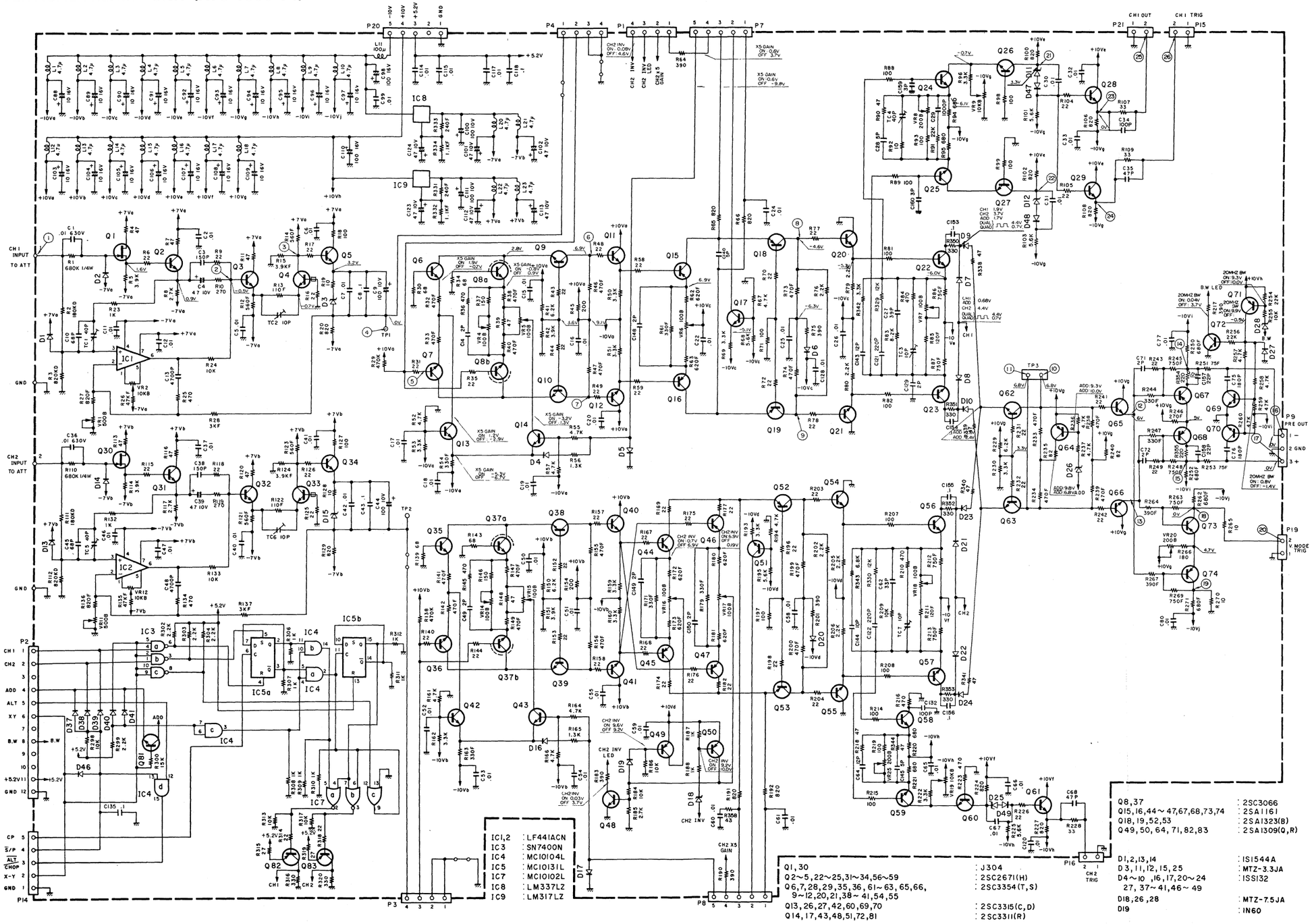
SCHEMATIC DIAGRAM



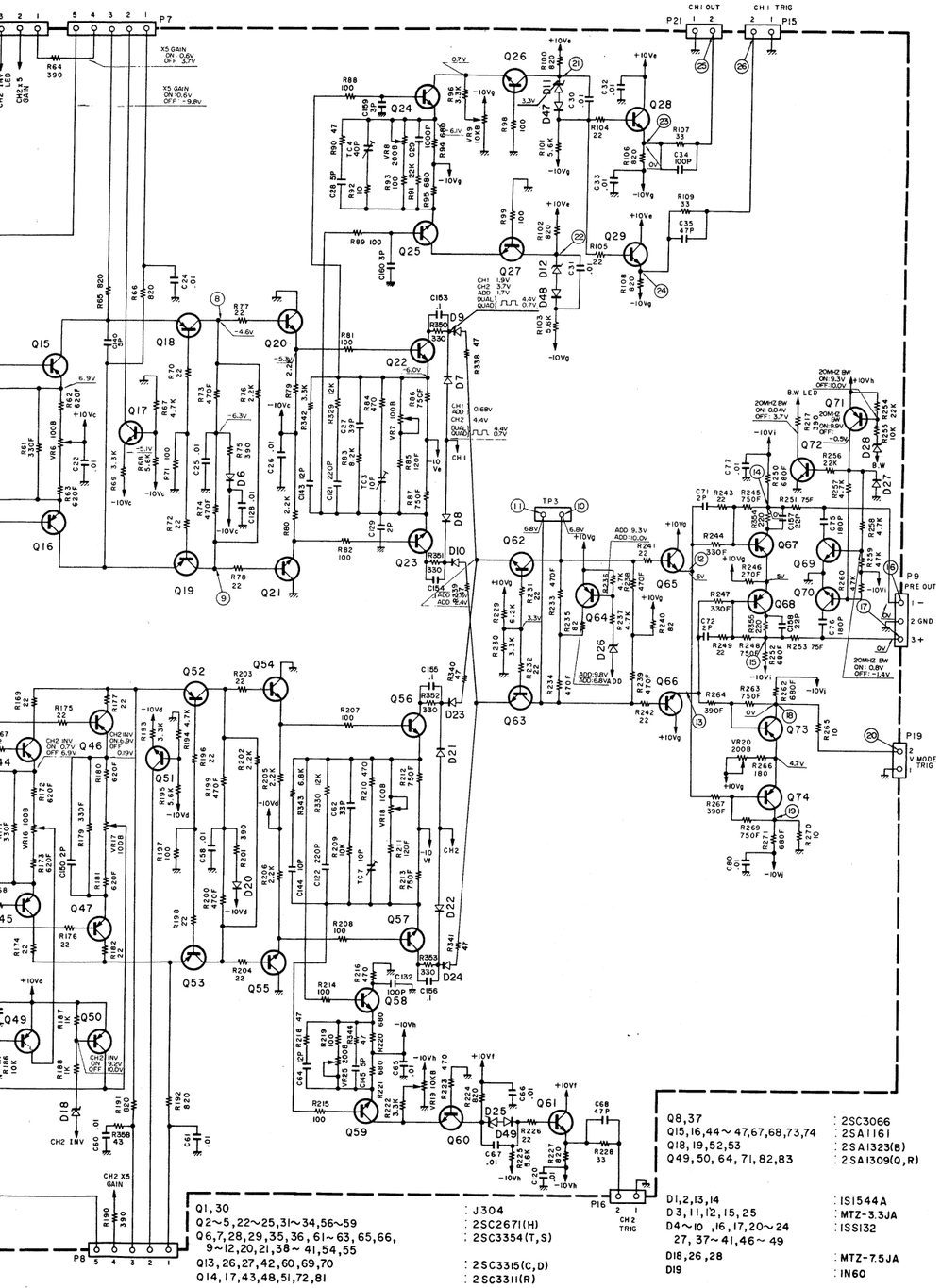
CS-1100A

SCHEMATIC DIAGRAM

VERTICAL PREAMP UNIT (X73-1500-04)

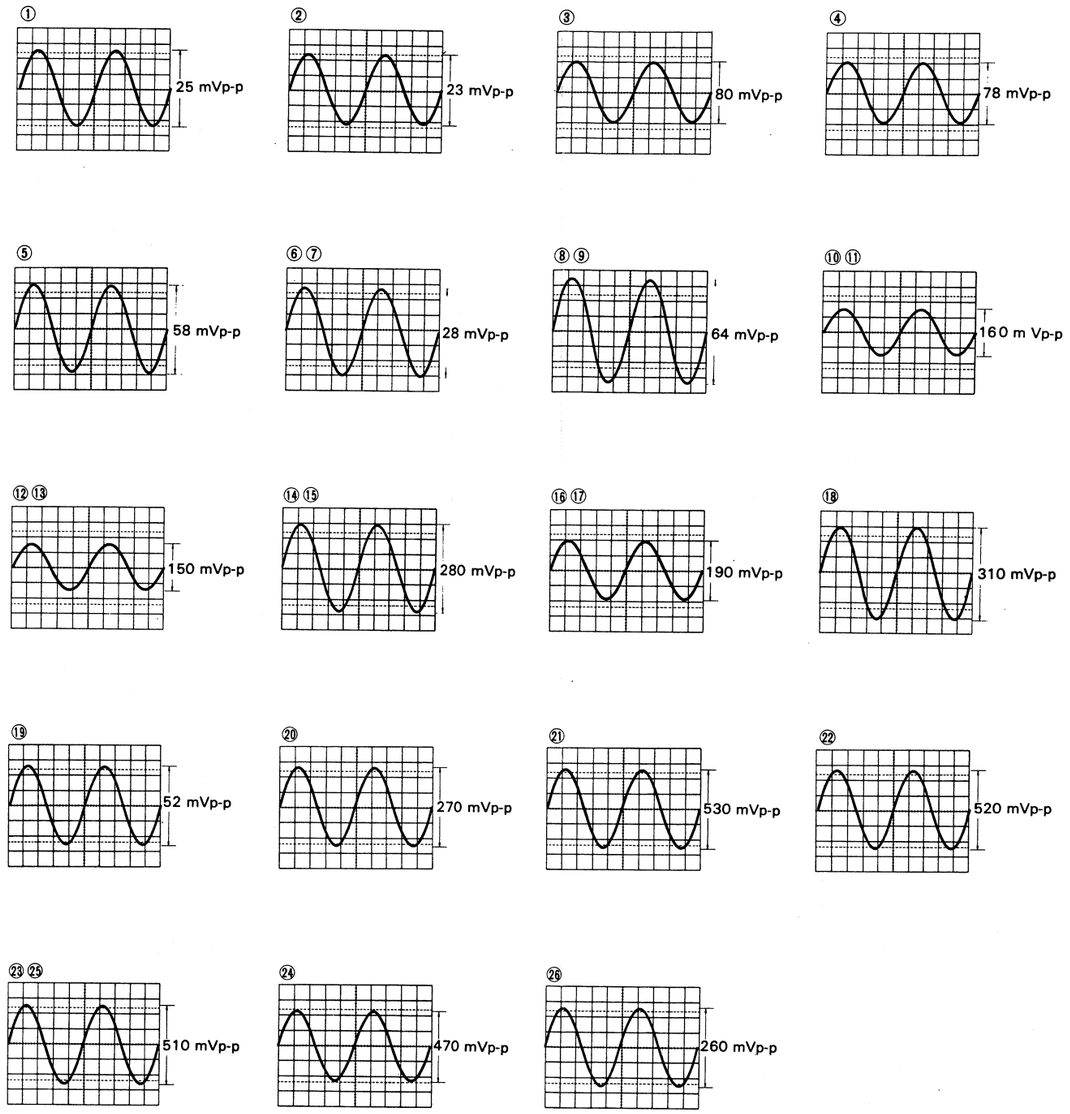


EMATIC DIAGRAM



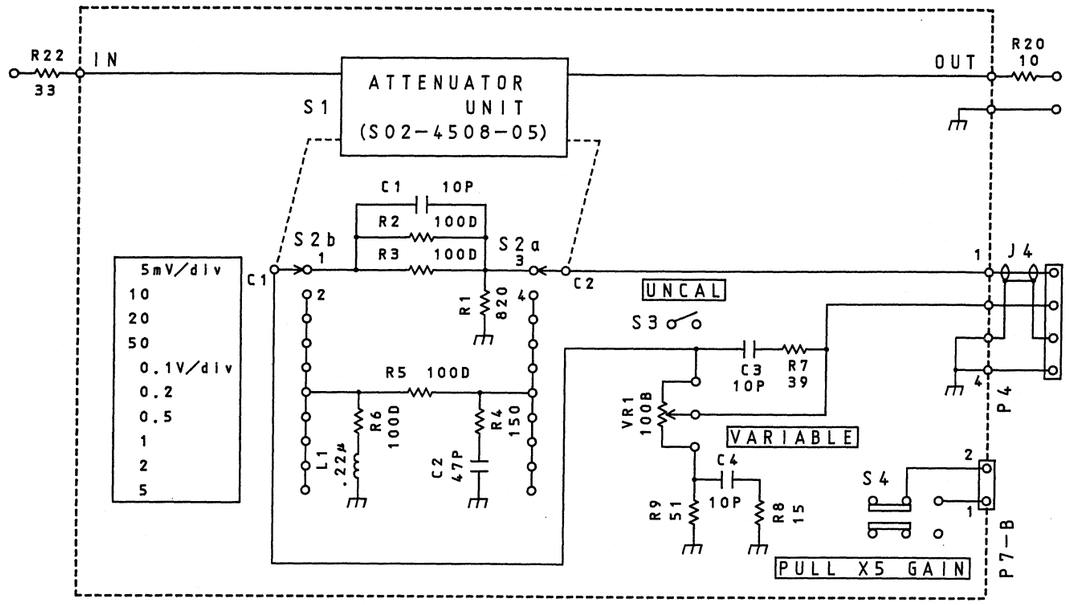
Q8,37	:	2SC3066
Q15,16,44~47,67,68,73,74	:	2SA1161
Q18,19,52,53	:	2SA1323(B)
Q49,50,64,71,82,83	:	2SA1309(Q,R)
Q1,30	:	J304
Q2~5,22~25,31~34,56~59	:	2SC2671(H)
Q6,7,28,29,35,36,61~63,65,66, 9~12,20,21,38~41,54,55	:	2SC3354(T,S)
Q13,26,27,42,60,69,70	:	2SC3315(C,D)
Q14,17,43,48,51,72,81	:	2SC3311(R)
D1,2,13,14	:	1SI544A
D3,11,12,15,25	:	MTZ-3.3JA
D4~10,16,17,20~24 27,37~41,46~49	:	1SS132
D18,26,28	:	MTZ-7.5JA
D19	:	IN60

WAVEFORMS

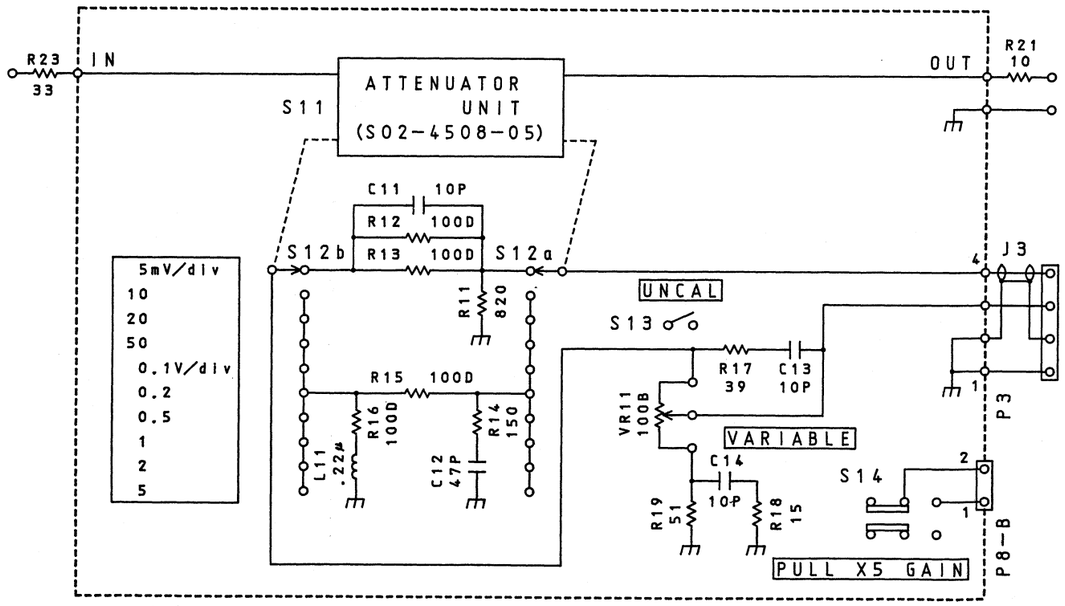


SCHEMATIC DIAGRAM

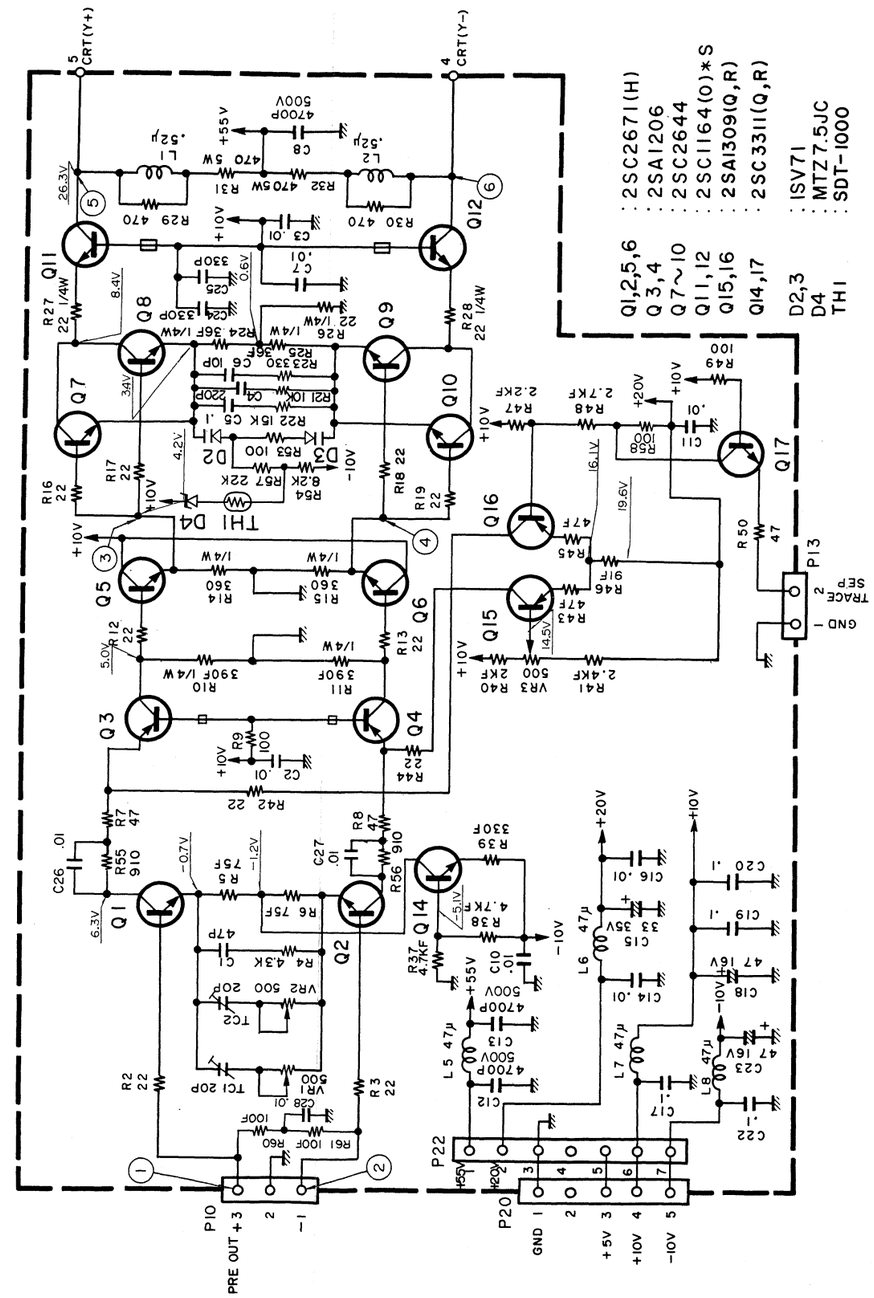
VERTICAL ATTENUATOR UNIT (CH1) (X75-1170-00 A/2)



VERTICAL ATTENUATOR UNIT (CH2) (X75-1170-00 B/2)

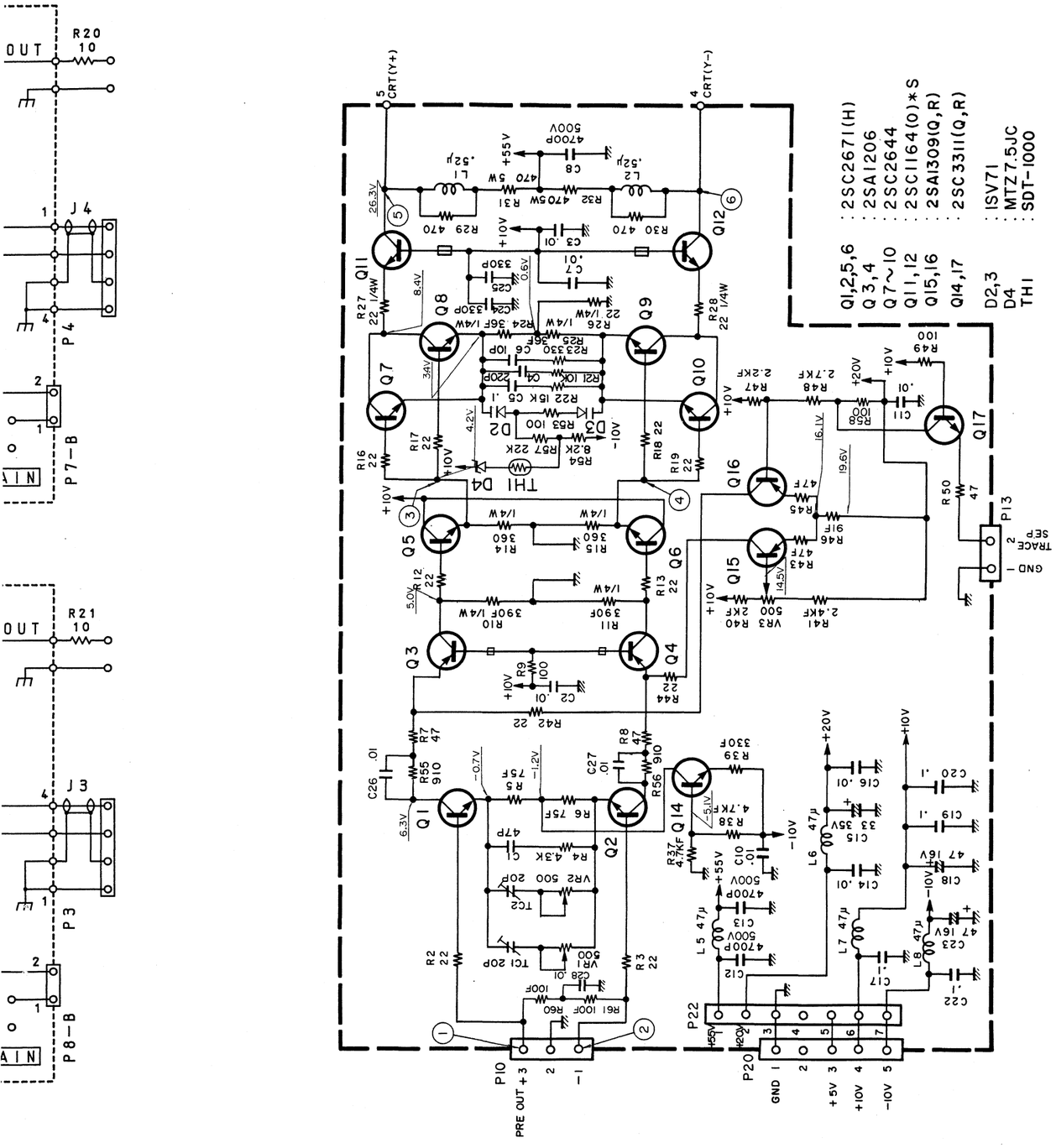


VERTICAL OUTPUT AMP UNIT (X73-1510-04)

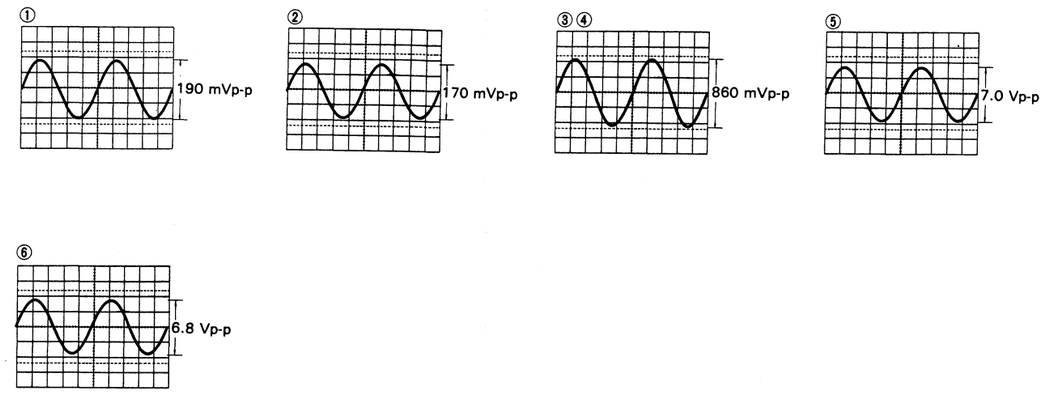


SCHEMATIC DIAGRAM

VERTICAL OUTPUT AMP UNIT (X73-1510-04)

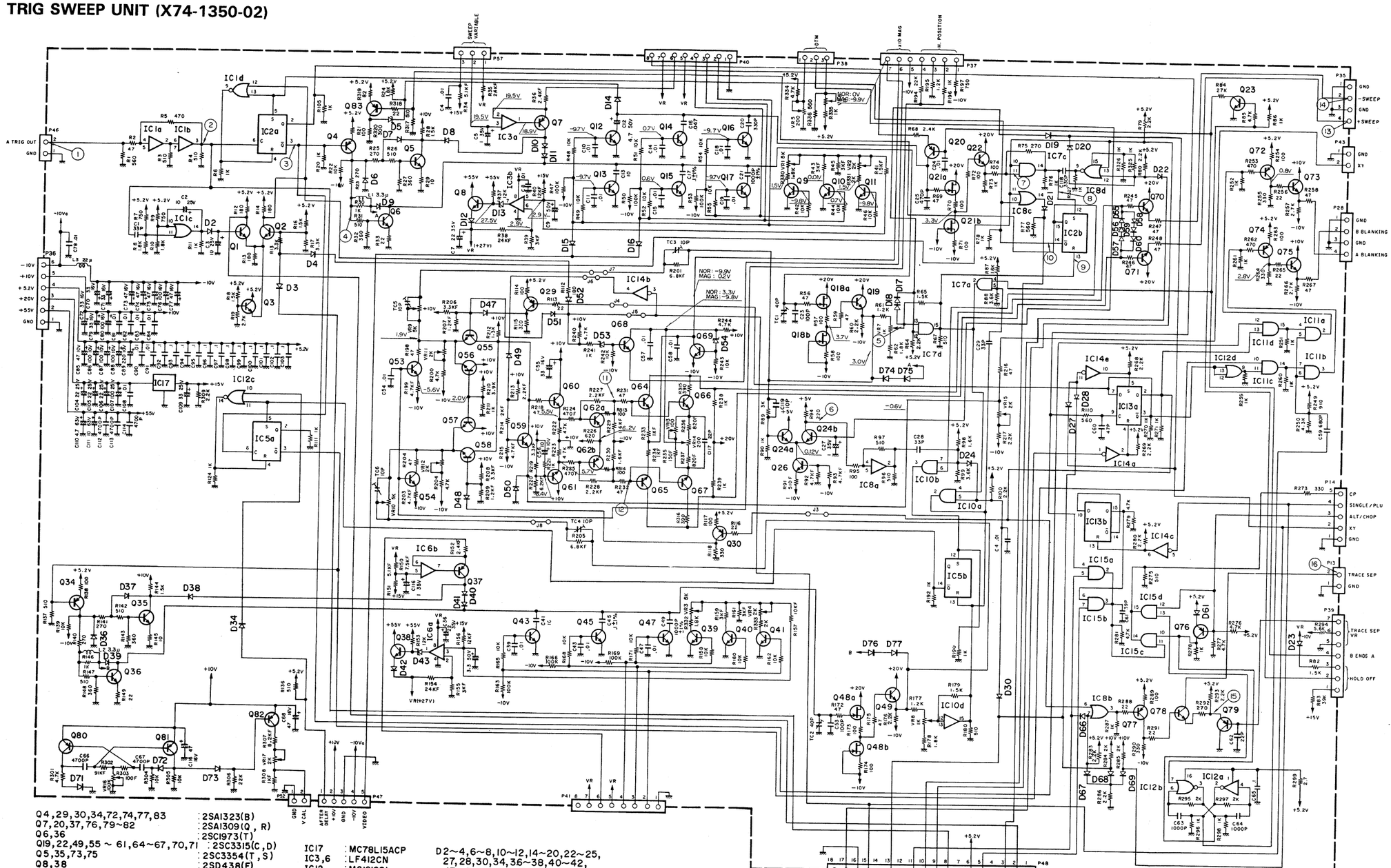


WAVEFORMS



SCHEMATIC DIAGRAM

TRIG SWEEP UNIT (X74-1350-02)

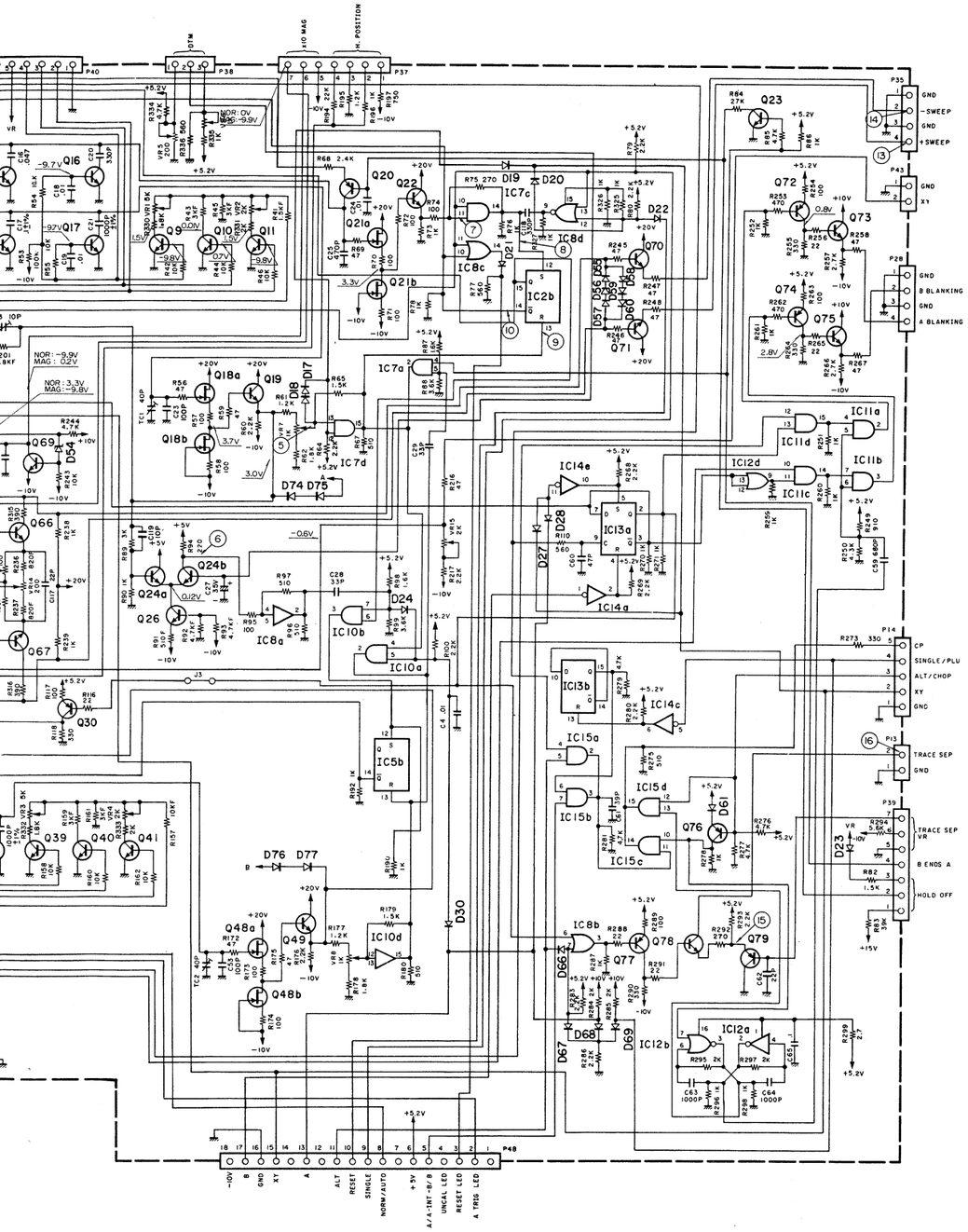


Q4,29,30,34,72,74,77,83	:2SAI323(B)
Q7,20,37,76,79~82	:2SAI309(Q, R)
Q6,36	:2SCI973(T)
Q19,22,49,55 ~ 61,64~67,70,71	:2SC3315(C,D)
Q5,35,73,75	:2SC3354(T,S)
Q8,38	:2SD438(F)
Q1~3,9~17,23,26,39~41,43, 45,47,53,54,68,69,78	:2SC3311(R)
Q18,21,48	:μPA68H(L)
Q62	:2SA1239
Q24	:2SC3066

IC17	:MC78LI5ACP
IC3,6	:LF412CN
IC12	:MCI0102L
IC8	:MCI0103L
IC7,10,11,15	:MCI0104L
IC13	:MCI0131L
IC14	:SN7406N
IC1	:MCI0HI03L
IC2,5	:MCI0HI31L

D2~4,6~8,10~12,14~20,22~25, 27,28,30,34,36~38,40~42, 47~52,61,66~69,71,72, 74~77	:ISS132
D5	:MTZ-3.0JB
D73	:IN60
D53,54	:MTZ-12JC
D13,43	:MTZ-16JA
D55,60	:SV06Y
D73	:IN60
D9,39	:MA-700
D21	:ISS16
D56~59	:ISI587

MATIC DIAGRAM



WAVEFORMS

① 4.2 V, 1.5 Vp-p

② 4.3 V, 3.3 V

③ 4.4 V, 3.3 V

④ 2.7 V, 1.7 V, 0 V

⑤ 3.7 V, 1.6 V

⑥

⑦ 3.8 V, 3 V

⑧ 4.4 V, 3.4 V

⑨ 4.4 V, 3.4 V

⑩ 4.4 V, 3.4 V

⑪ -1 0.6 V, −1.5 V

⑪ -2 1 Vp-p
Input: CH2,
H DISPLAY: X-Y

⑮ 0.68 V, 0.64 V
HORIZ DISPLAY: ALT
▲▼TRACE SEP: Fully CCW

⑯ 10.0 V, 9.5 V
HORIZ DISPLAY: ALT
▲▼TRACE SEP: Fully CCW

⑫ -1 0.5 V, −1.4 V

⑫ -2 0.9 Vp-p
Input: CH2,
H DISPLAY: X-Y

⑬ -1 11.8 V, 9.8 V

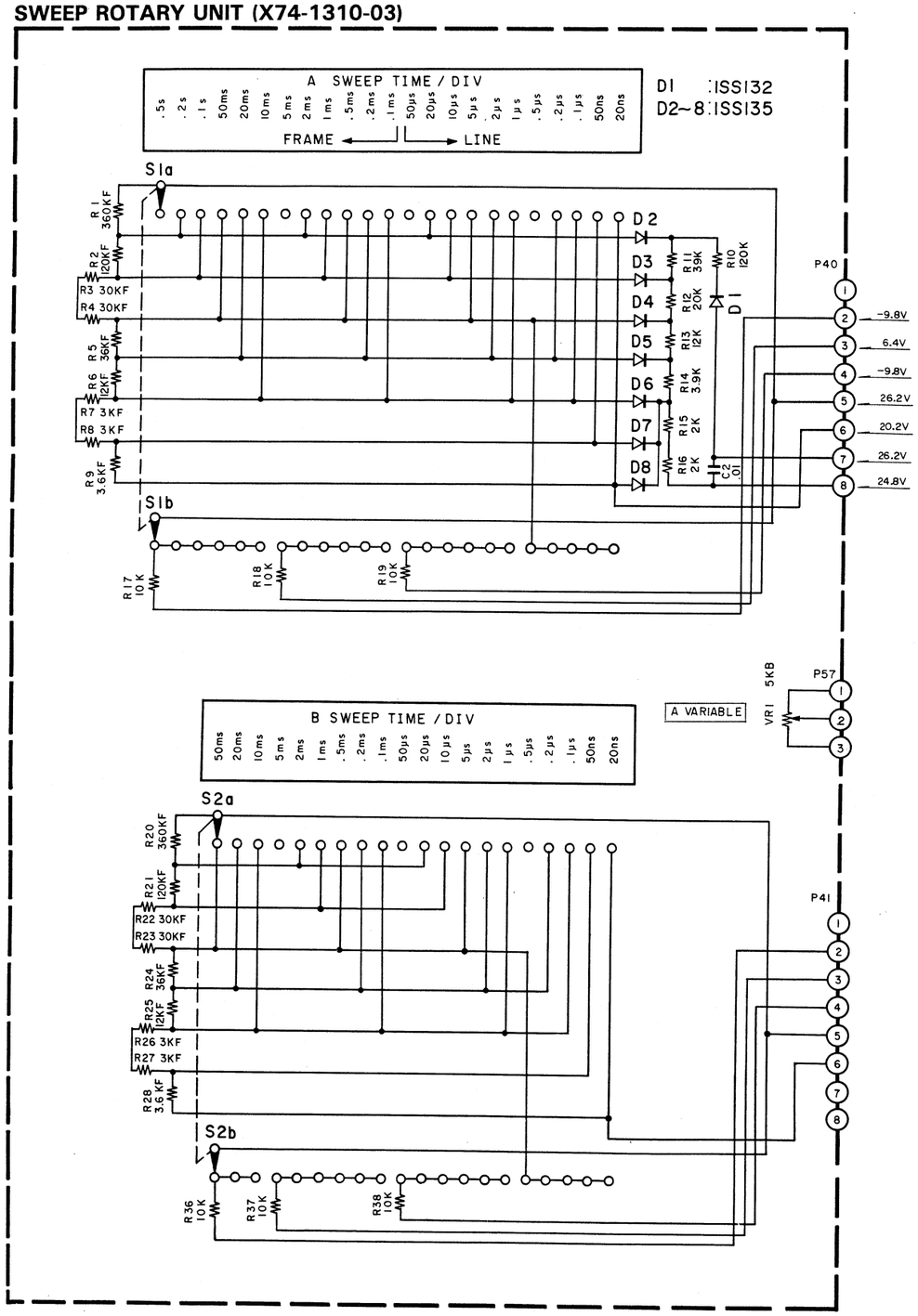
⑬ -2 0.9 Vp-p
Input: CH2,
H DISPLAY: X-Y

⑭ -1 11.5 V, 9.8 V

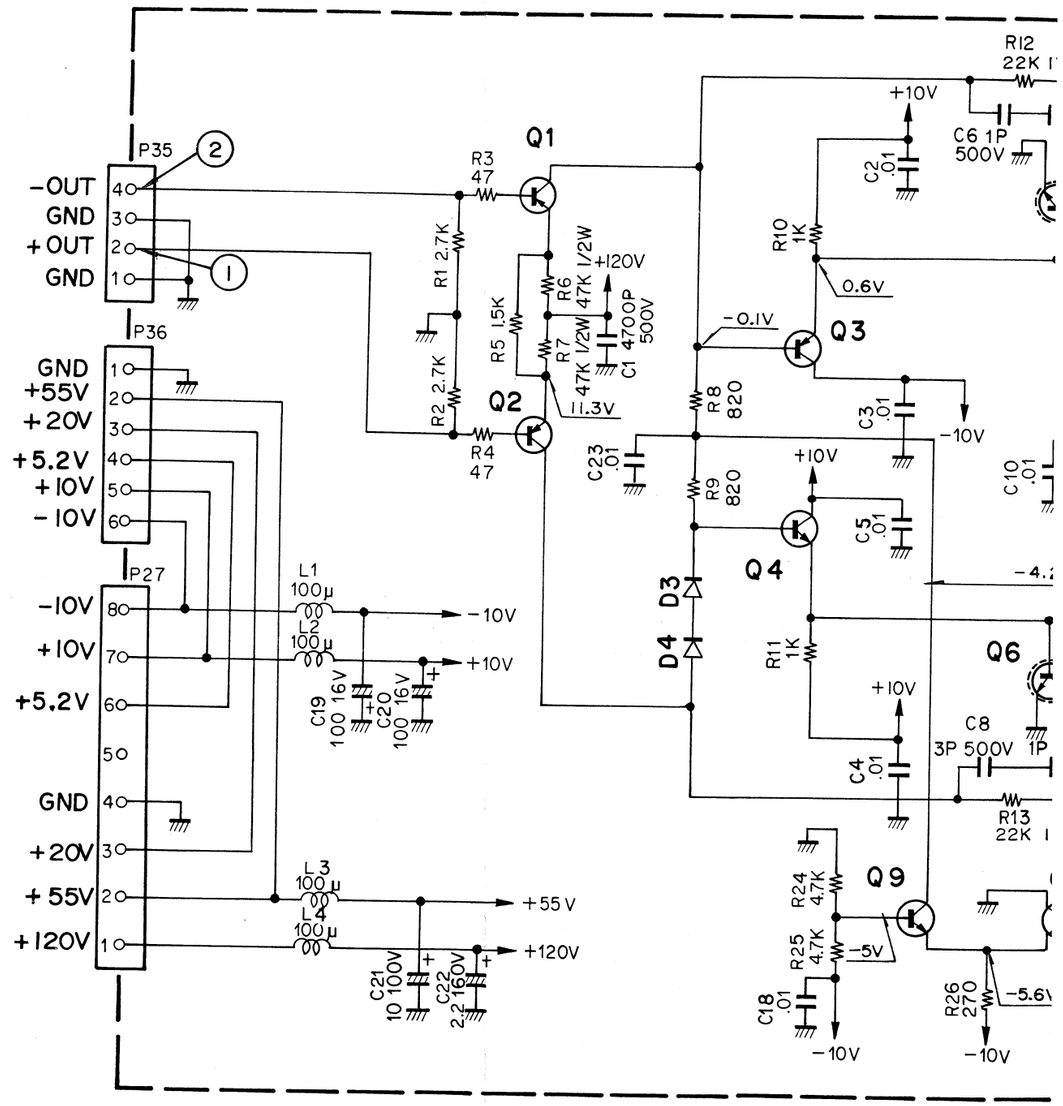
⑭ -2 0.8 Vp-p
Input: CH2,
H DISPLAY: X-Y

SCHEMATIC DIAGRAM

SWEEP ROTARY UNIT (X74-1310-03)

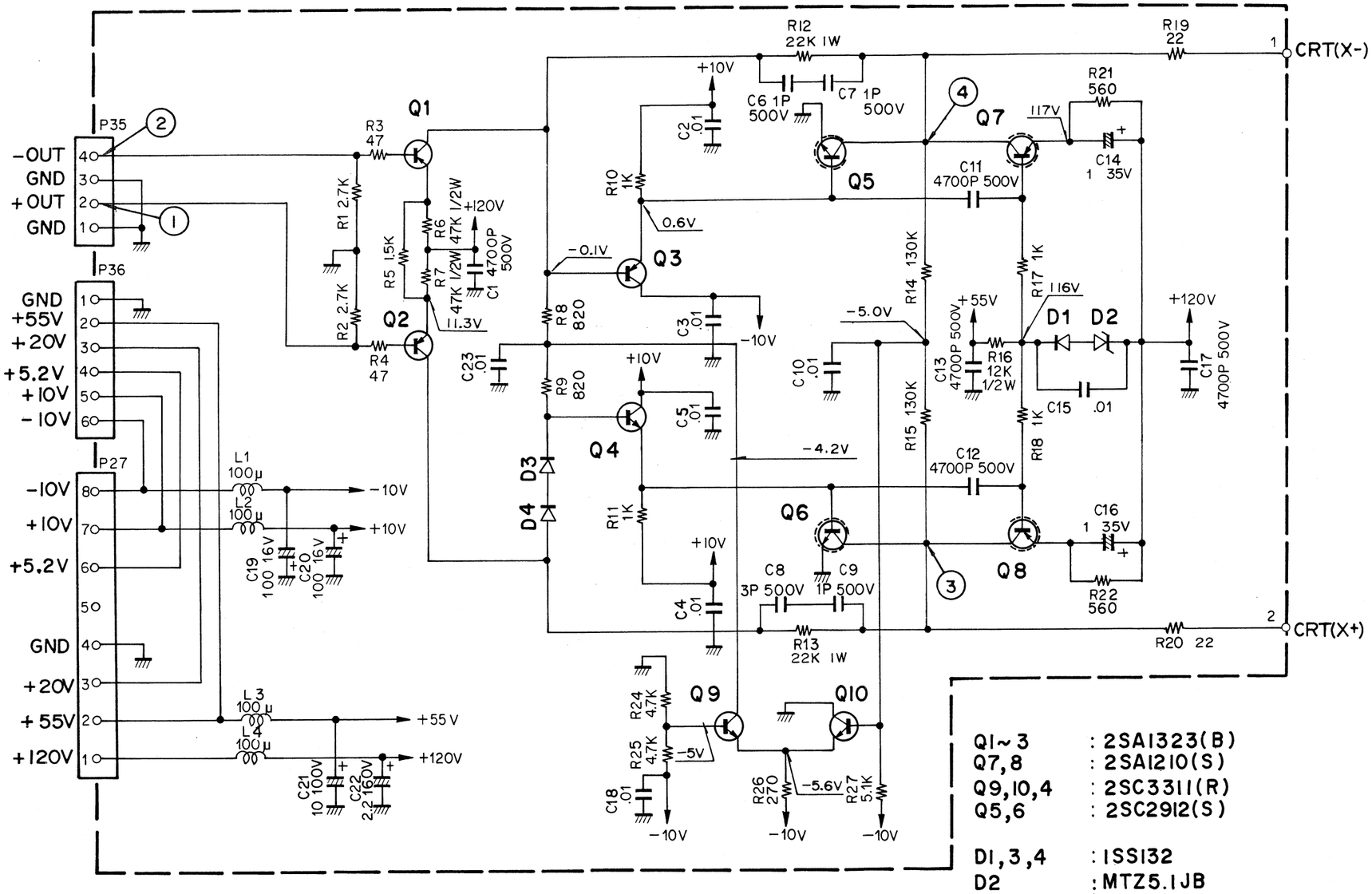


HORIZONTAL OUTPUT AMP UNIT (X74-1360-02)



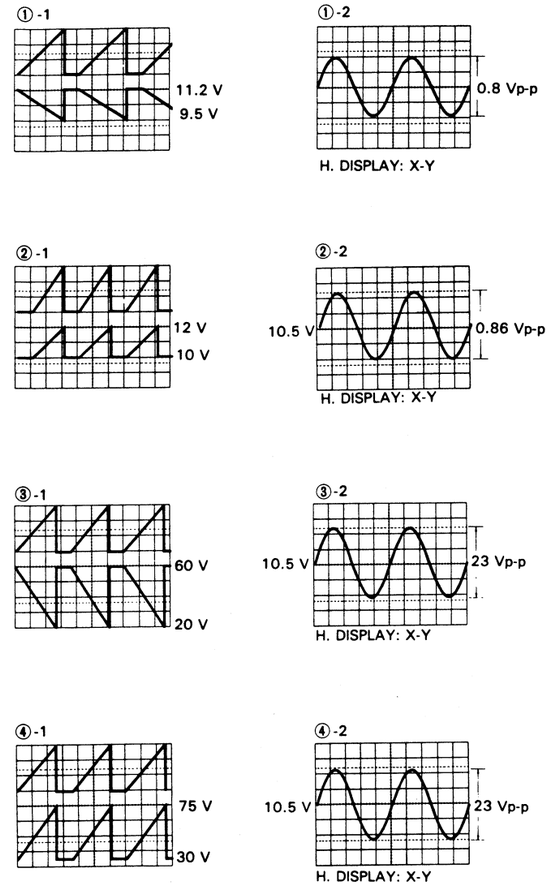
SCHEMATIC DIAGRAM

HORIZONTAL OUTPUT AMP UNIT (X74-1360-02)



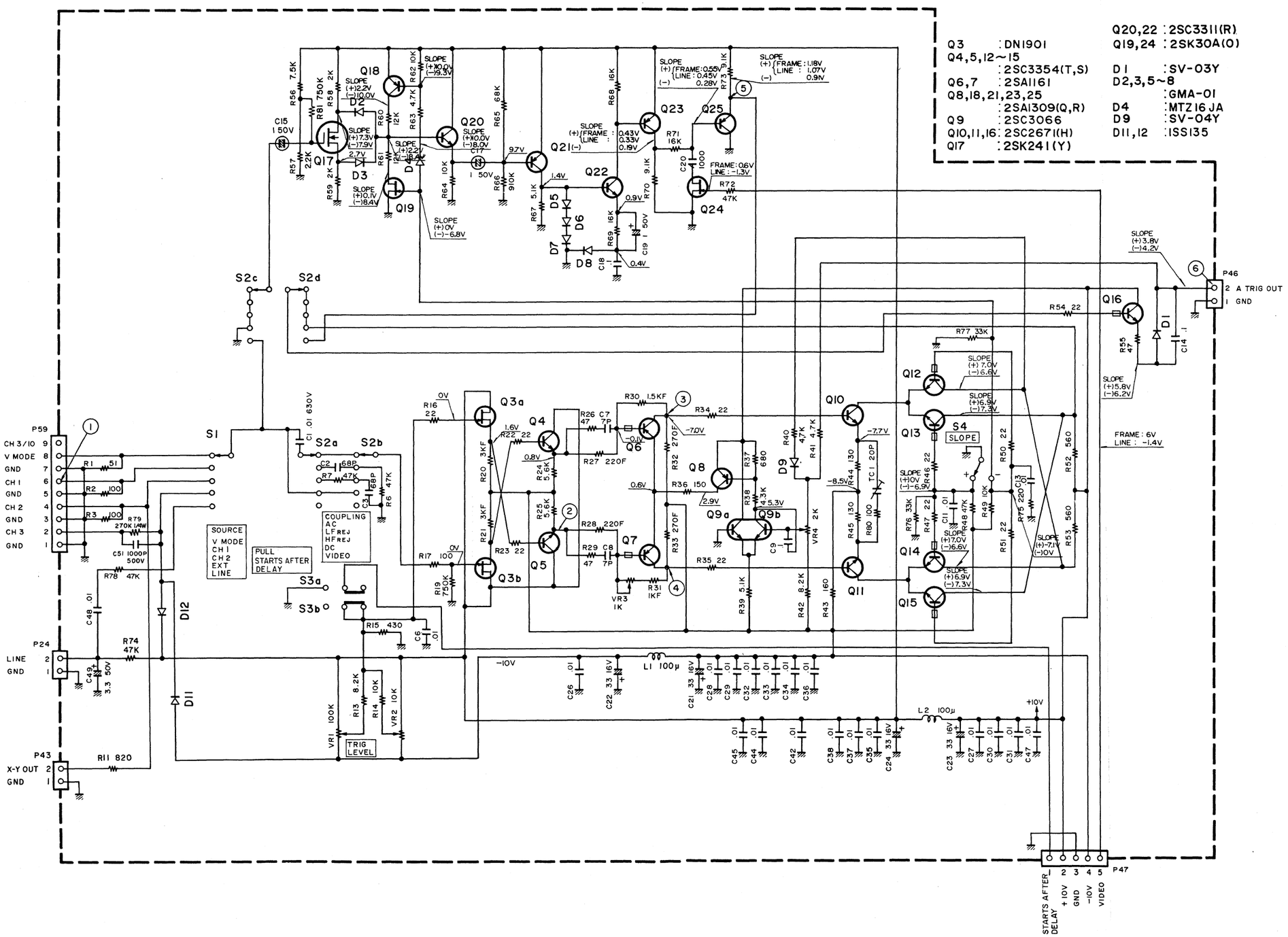
Q1~3	: 2SA1323(B)
Q7,8	: 2SA1210(S)
Q9,10,4	: 2SC3311(R)
Q5,6	: 2SC2912(S)
D1,3,4	: 1SS132
D2	: MTZ5.1JB

WAVEFORMS

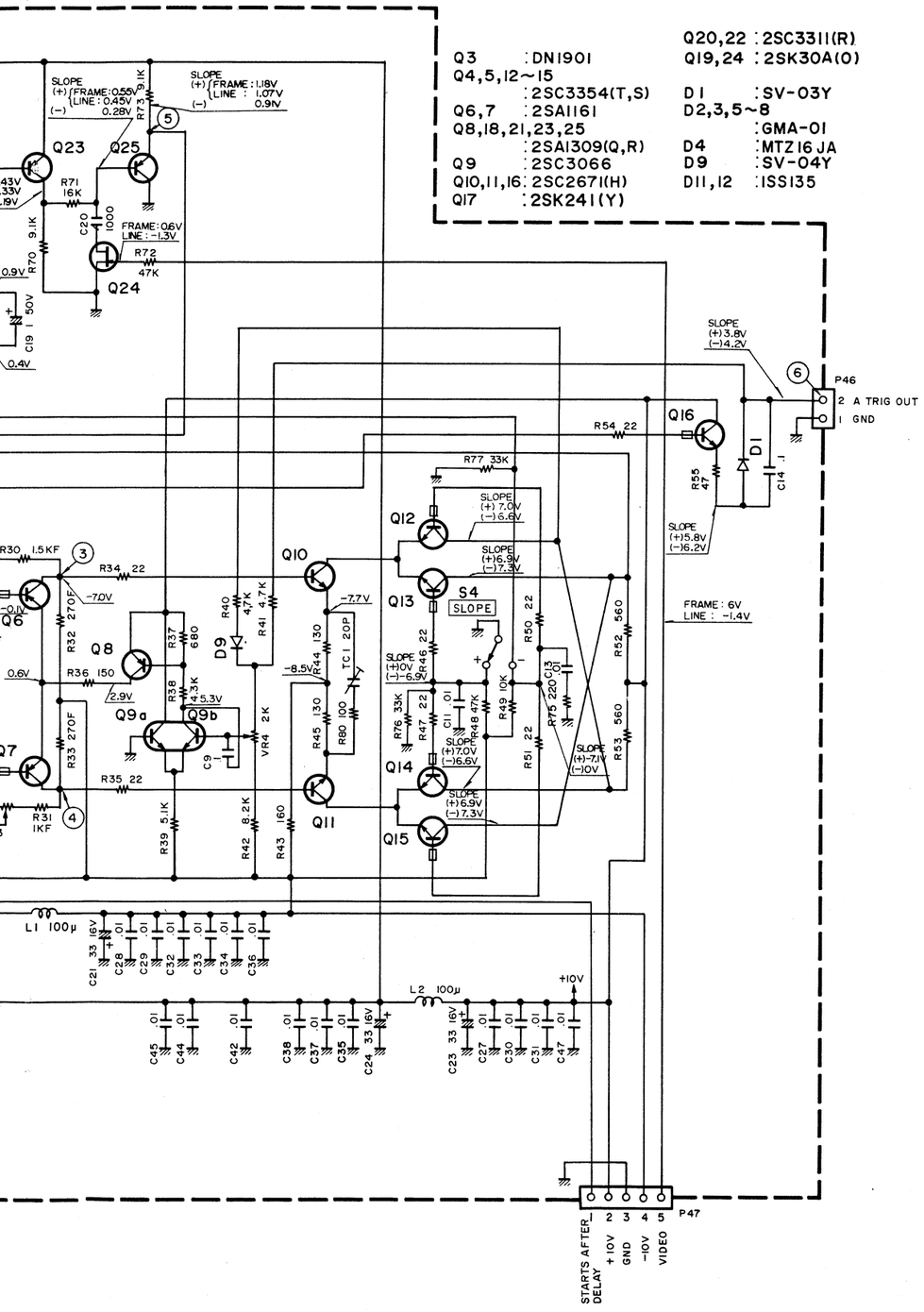


SCHEMATIC DIAGRAM

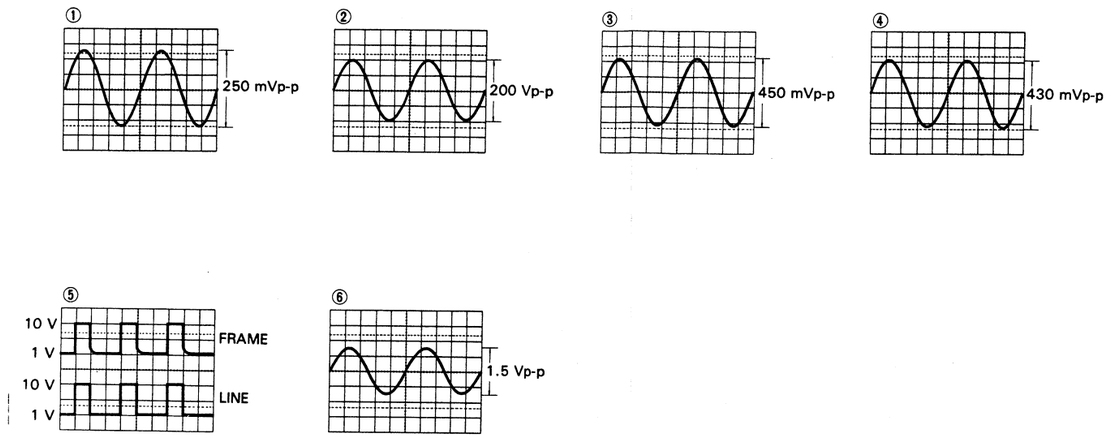
A TRIG SWITCH UNIT (X77-1280-02)



MATIC DIAGRAM

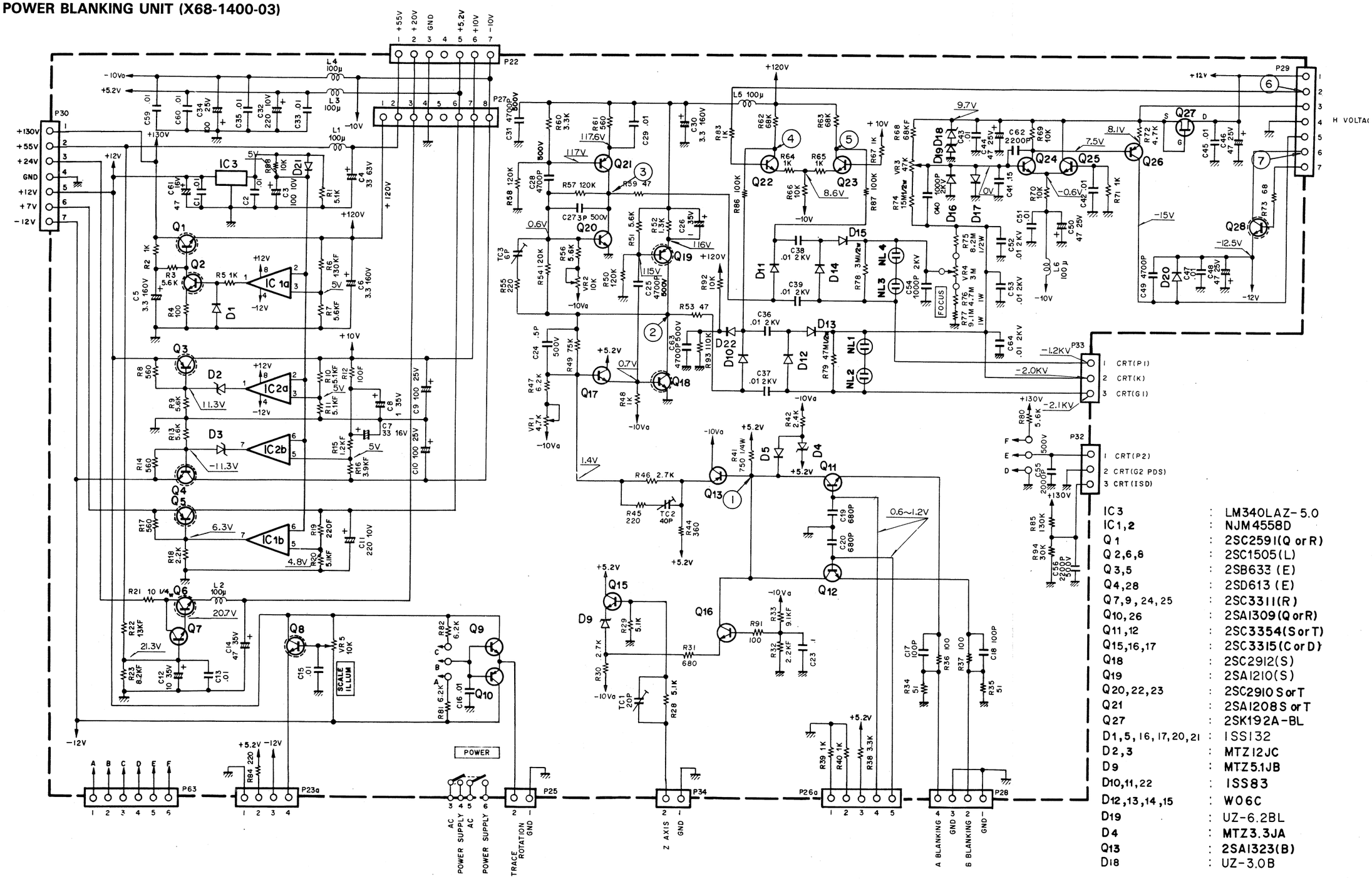


WAVEFORMS



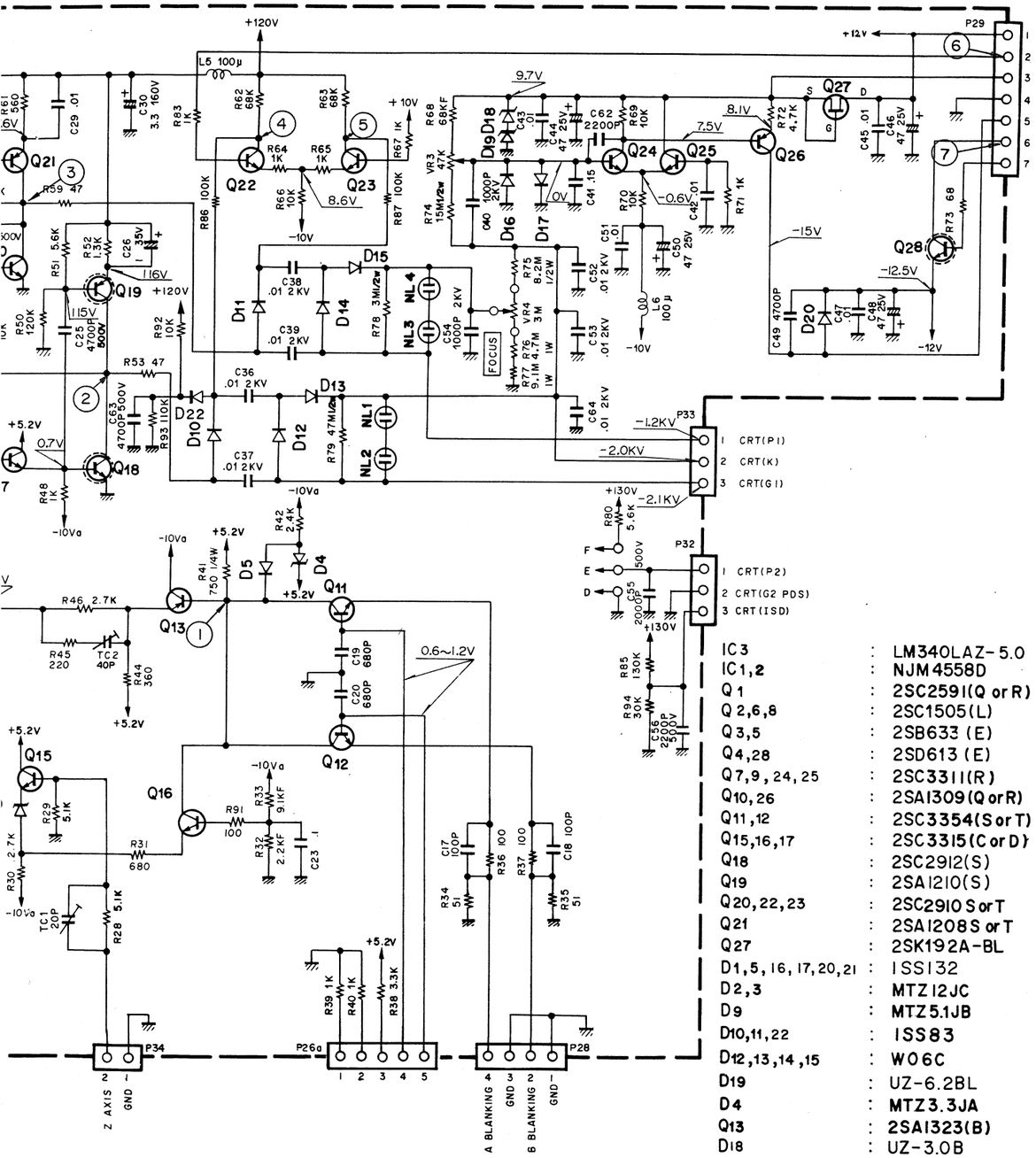
SCHEMATIC DIAGRAM

POWER BLANKING UNIT (X68-1400-03)



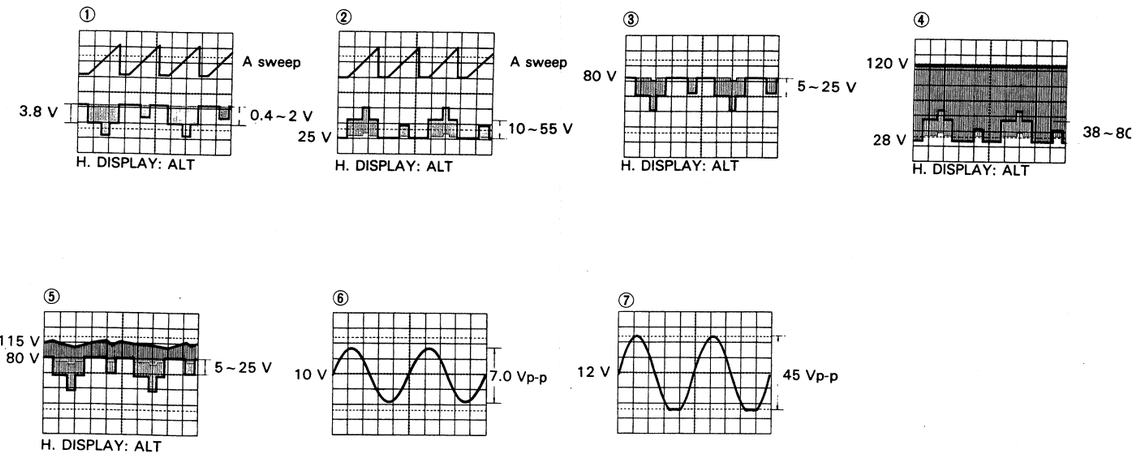
IC3	:	LM340LAZ-5.0
IC1,2	:	NJM4558D
Q1	:	2SC2591(Q or R)
Q2,6,8	:	2SC1505(L)
Q3,5	:	2SB633 (E)
Q4,28	:	2SD613 (E)
Q7,9,24,25	:	2SC3311(R)
Q10,26	:	2SA1309(Q or R)
Q11,12	:	2SC3354(S or T)
Q15,16,17	:	2SC3315(C or D)
Q18	:	2SC2912(S)
Q19	:	2SA1210(S)
Q20,22,23	:	2SC2910 S or T
Q21	:	2SA1208 S or T
Q27	:	2SK192A-BL
D1,5,16,17,20,21	:	1SS132
D2,3	:	MTZ12JC
D9	:	MTZ5.1JB
D10,11,22	:	1SS83
D12,13,14,15	:	W06C
D19	:	UZ-6.2BL
D4	:	MTZ3.3JA
Q13	:	2SA1323(B)
D18	:	UZ-3.0B

SCHEMATIC DIAGRAM



IC3	:	LM340LAZ-5.0
IC1,2	:	NJM4558D
Q1	:	2SC2591(Q or R)
Q2,6,8	:	2SC1505(L)
Q3,5	:	2SB633 (E)
Q4,28	:	2SD613 (E)
Q7,9,24,25	:	2SC3311(R)
Q10,26	:	2SA1309(Q or R)
Q11,12	:	2SC3354(S or T)
Q15,16,17	:	2SC3315(C or D)
Q18	:	2SC2912(S)
Q19	:	2SA1210(S)
Q20,22,23	:	2SC2910 S or T
Q21	:	2SA1208S or T
Q27	:	2SK192A-BL
D1,5,16,17,20,21	:	1SS132
D2,3	:	MTZ12JC
D9	:	MTZ5.1JB
D10,11,22	:	1SS83
D12,13,14,15	:	W06C
D19	:	UZ-6.2BL
D4	:	MTZ3.3JA
Q13	:	2SA1323(B)
D18	:	UZ-3.0B

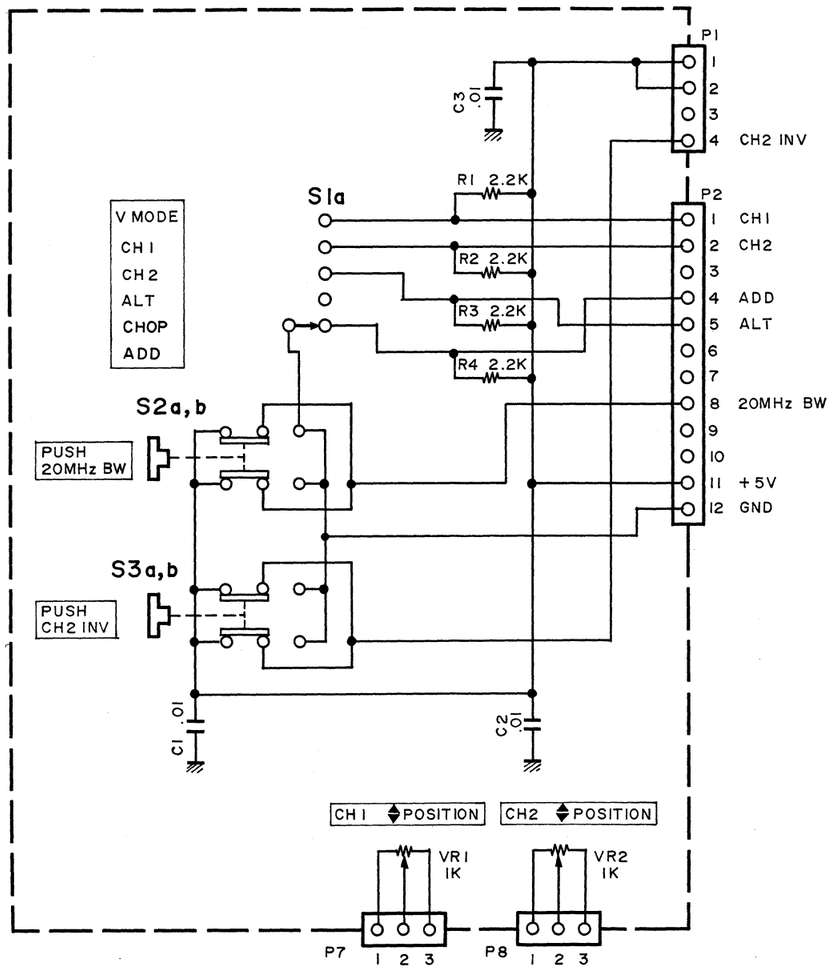
WAVEFORMS



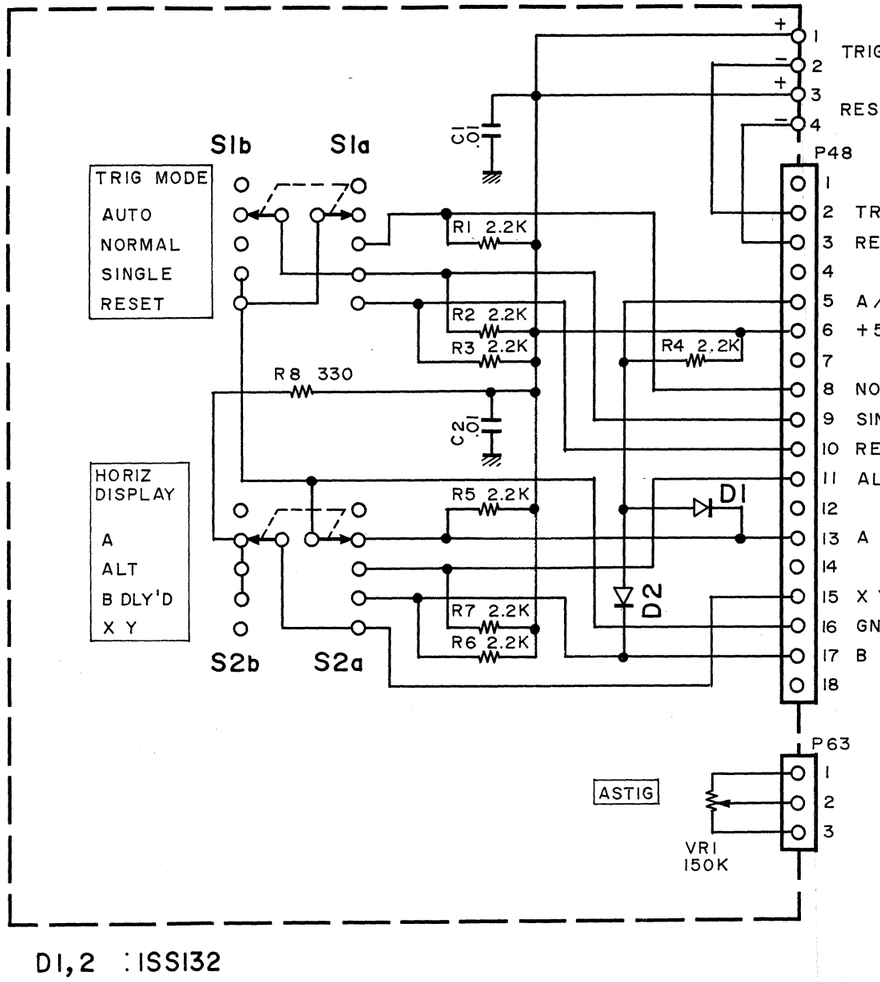
Note : IIII : CHOP Operation

SCHEMATIC DIAGRAM

VERTICAL MODE SWITCH UNIT (X77-1310-00)

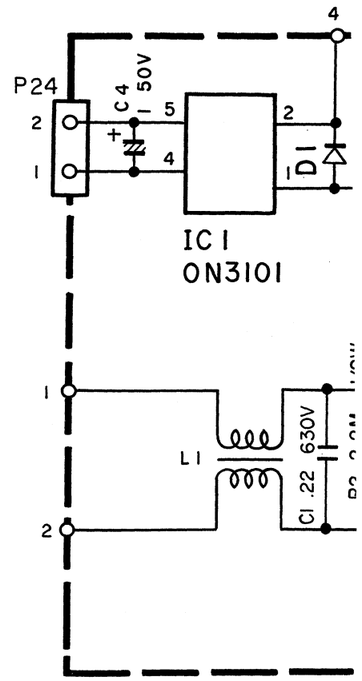


HORIZONTAL MODE SWITCH UNIT (X77-1320-00)



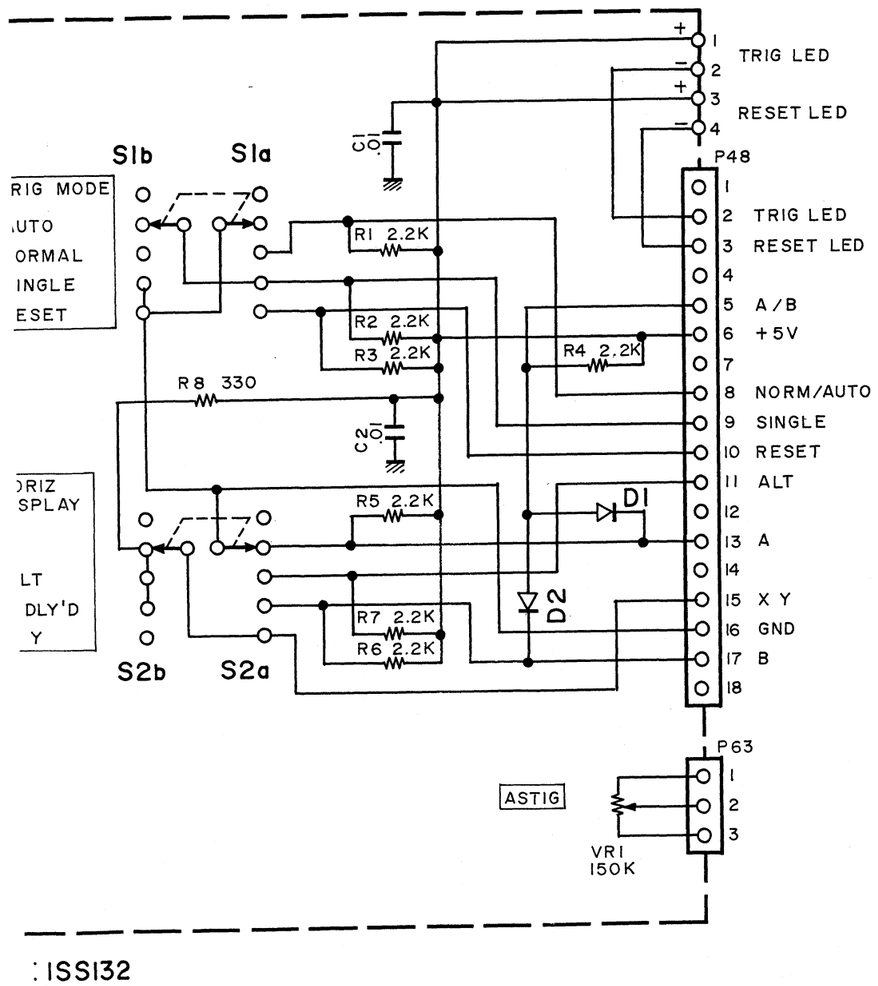
D1,2 : 1SS132

FILTER UNIT (X70-1020-00)



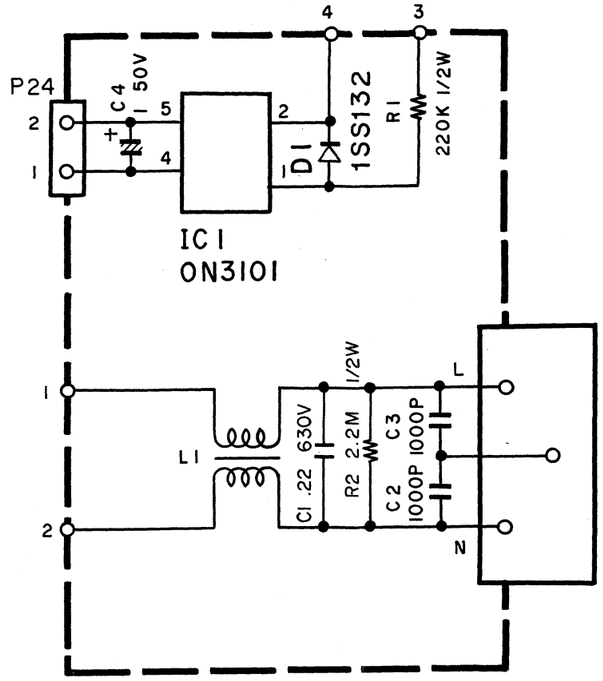
SCHEMATIC DIAGRAM

TAL MODE SWITCH UNIT (X77-1320-00)

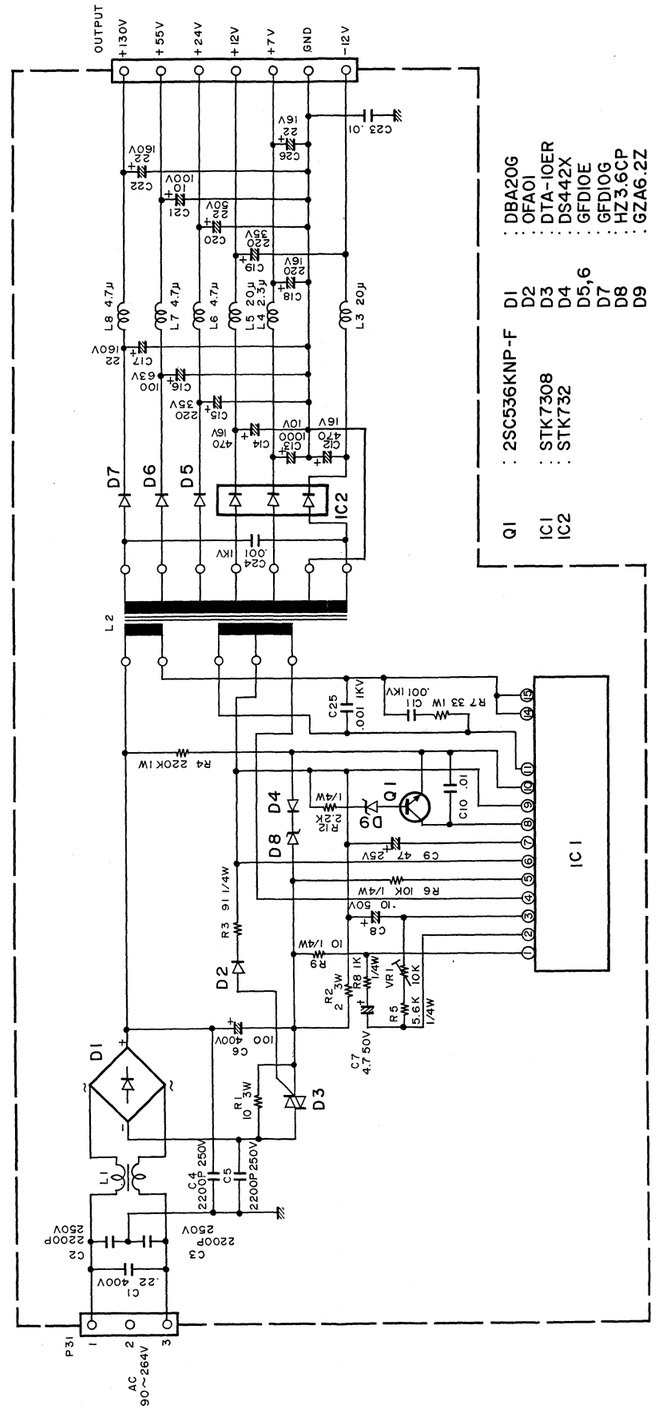


: 1SS132

FILTER UNIT (X70-1020-00)

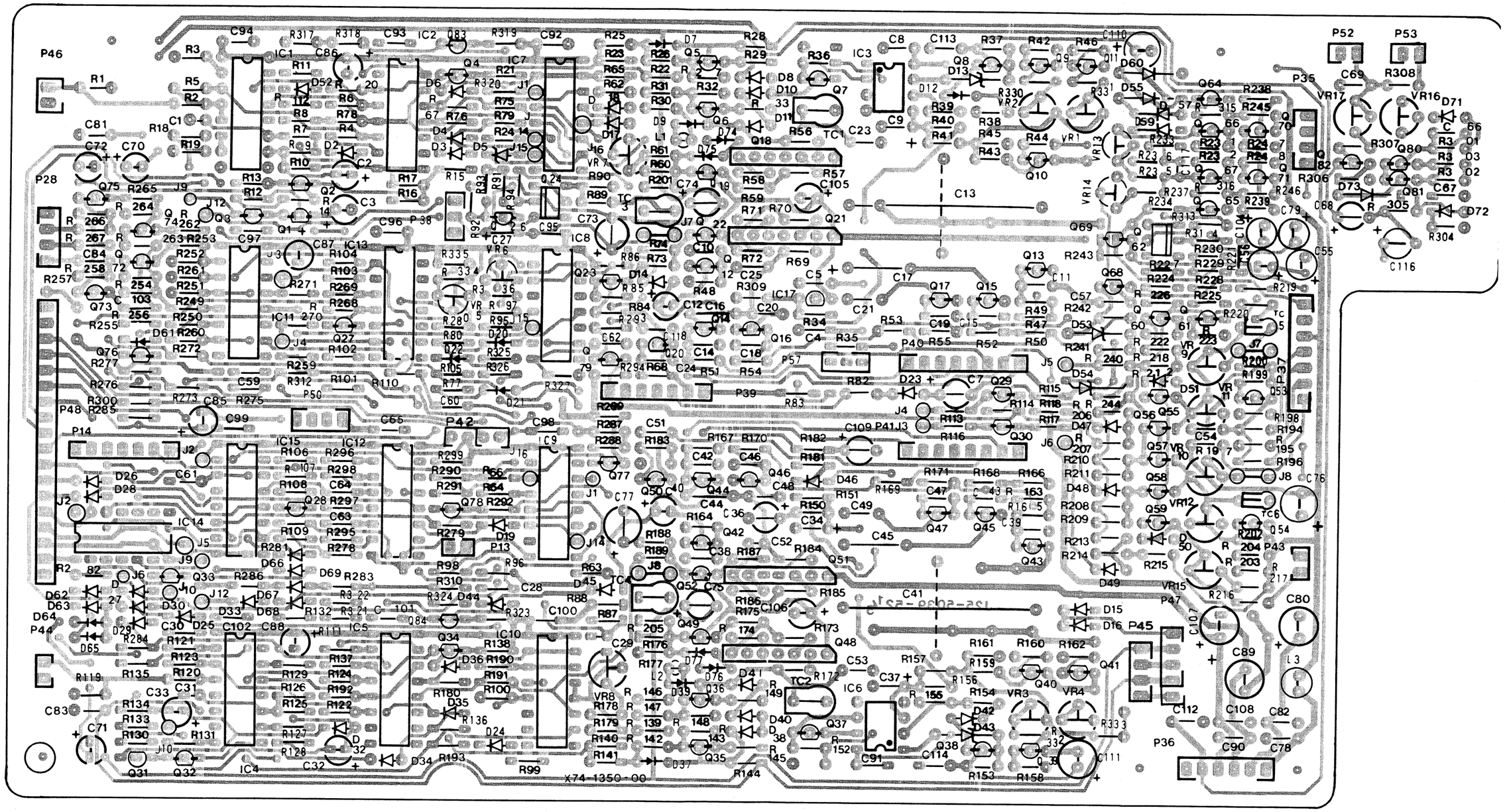


SWITCHING POWER SUPPLY UNIT (W02-0413-05)



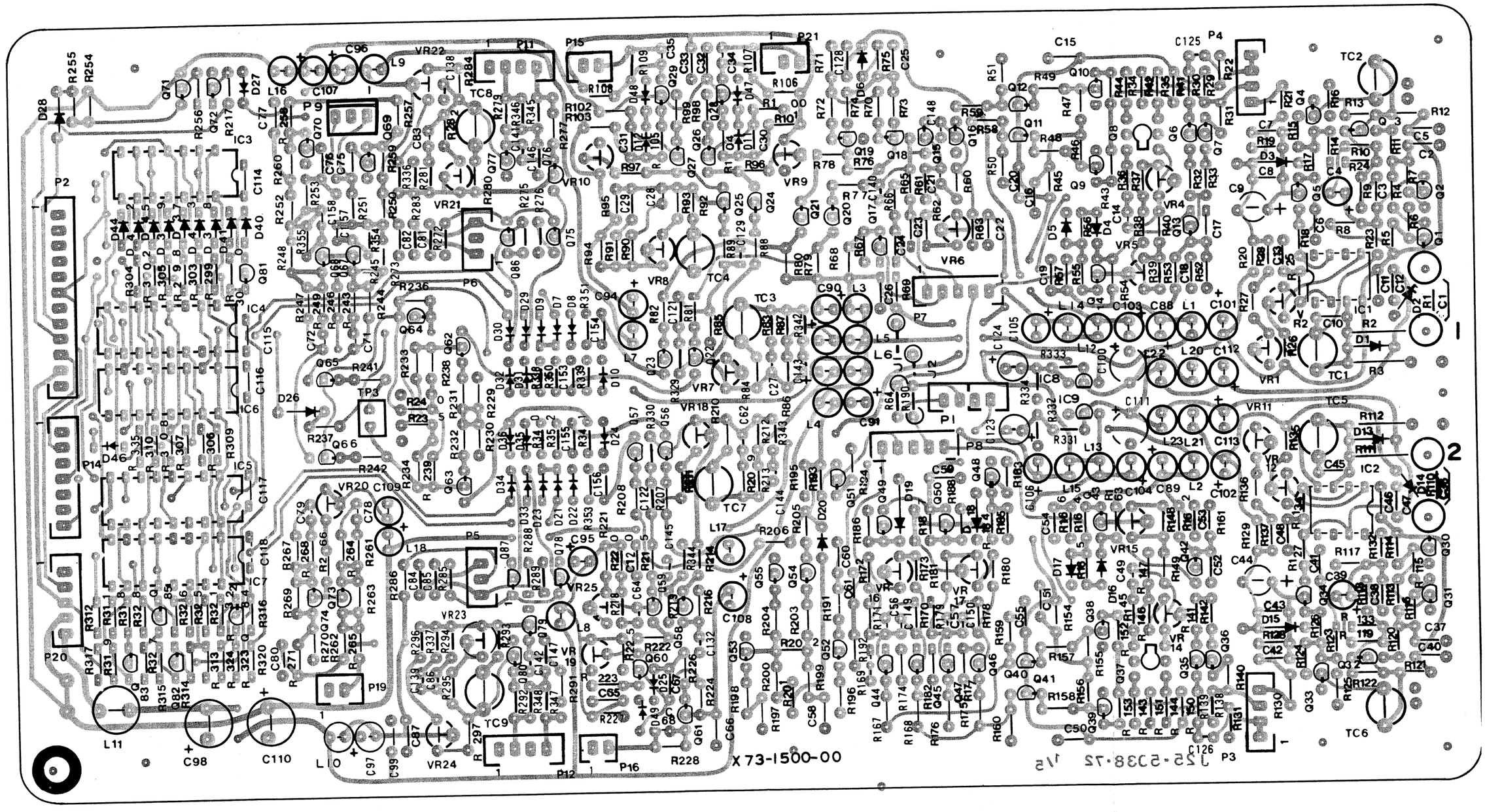
PC BOARD

TRIG SWEEP UNIT (X74-1350-02)



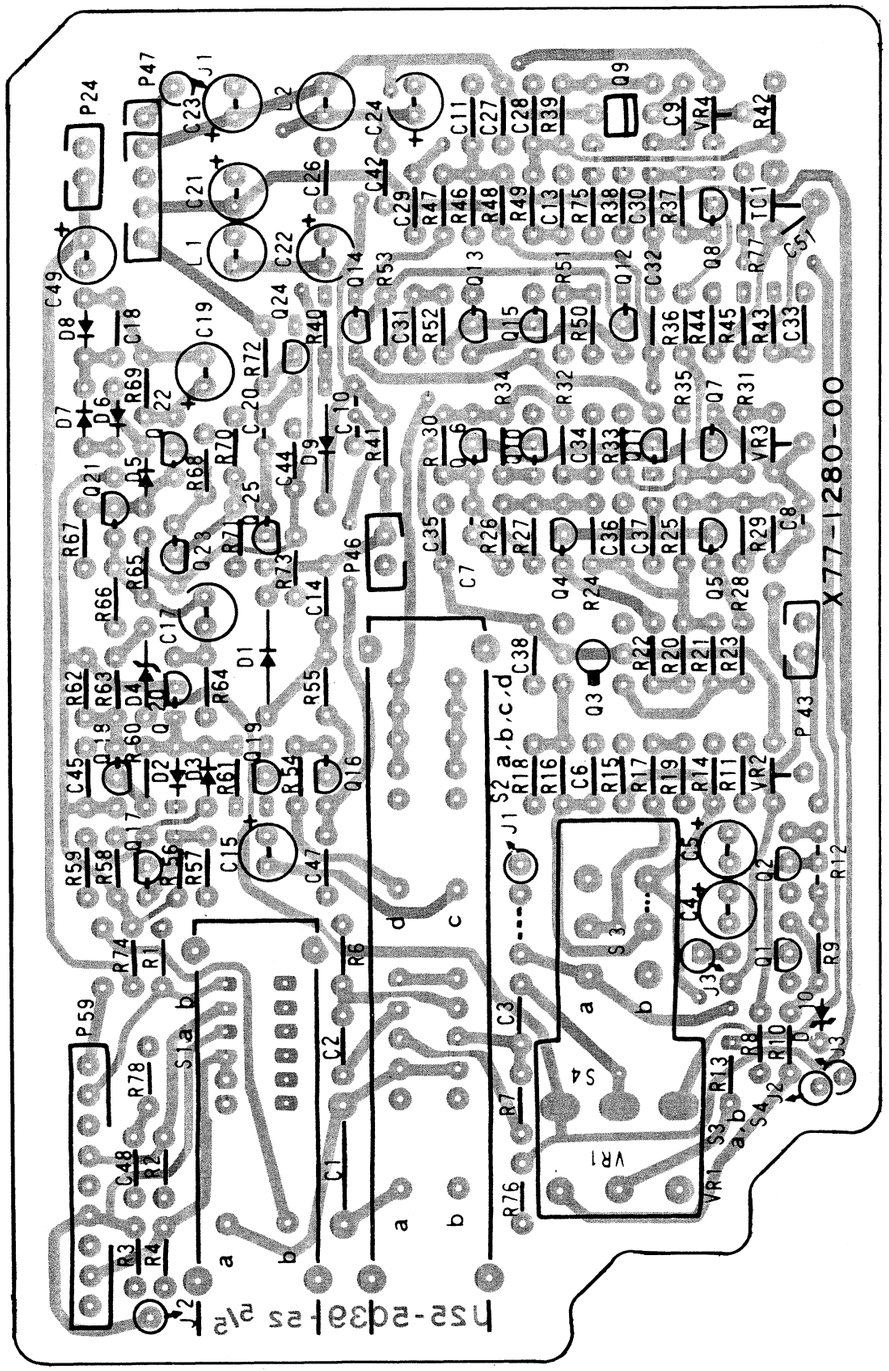
PC BOARD

VERTICAL PREAMP UNIT (X73-1500-04)

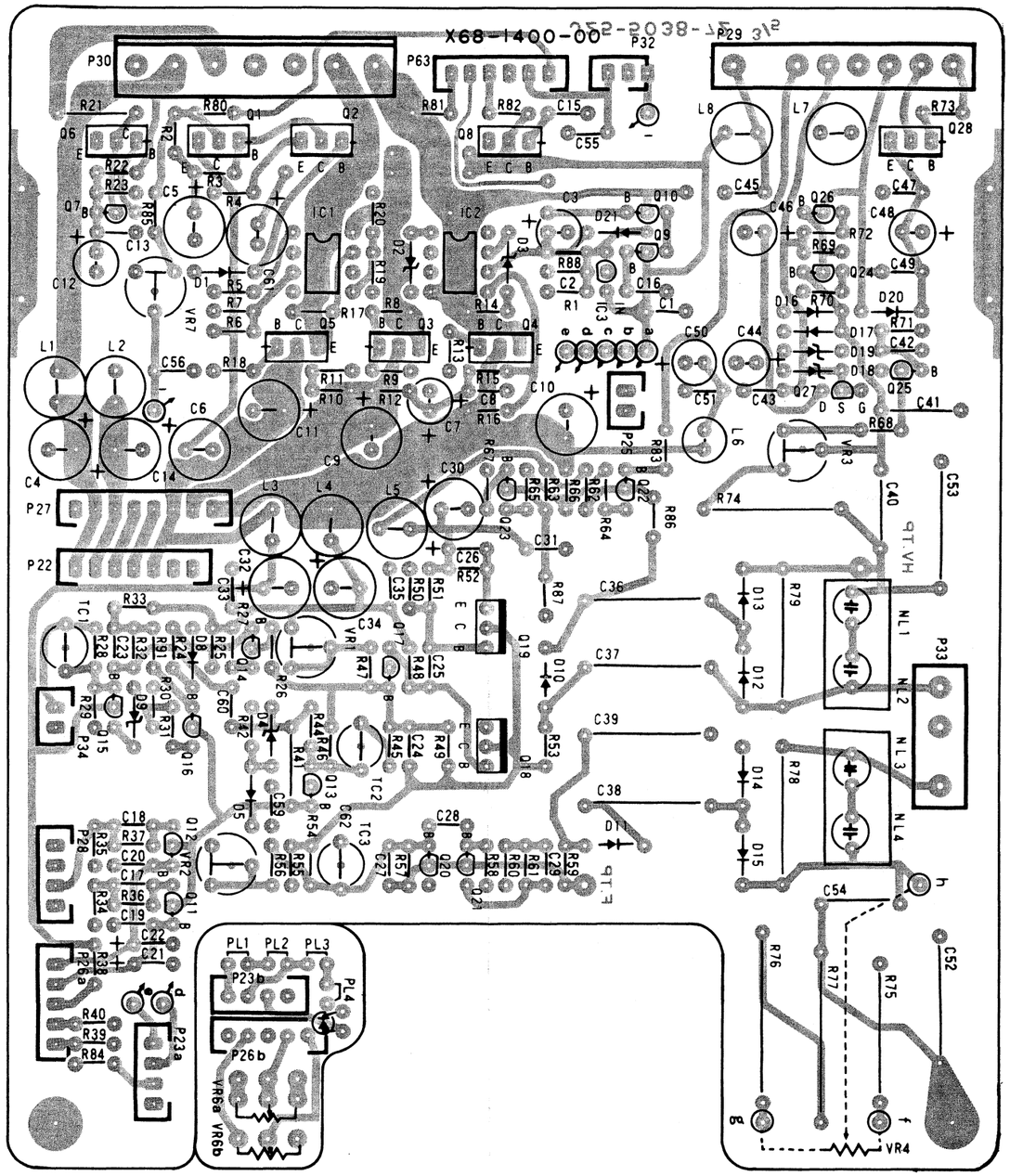


PC BOARD

A TRIG SWITCH UNIT (X77-1280-02)



POWER BLANKING UNIT (X68-1400-03)



DISASSEMBLY